“SINGLE DOSE PREOPERATIVE ANTIBIOTIC ON CLEAN CASES”

Dissertation submitted

To

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY, CHENNAI

In partial fulfillment of the regulations for the award of the degree of

M.S (General Surgery)

Branch-I

GOVERNMENT KILPAUK MEDICAL COLLEGE CHENNAI

April -2015

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation titled "**SINGLE DOSE PREOPERATIVE ANTIBIOTIC ON CLEAN CASES"** is a bonafide and genuine research work carried out by me under the guidance of Prof.Dr.K.K.VIJAYA KUMAR, M.S in the Department of General Surgery, Kilpauk Medical College, Chennai-10.

This dissertation is submitted to **THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY CHENNAI** in partial fulfillment of the university regulations of the Tamil Nadu Dr. M.G.R medical university, Chennai for M.S. General Surgery examination to be held in **April 2015**.

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SINGLEDOSE PREOPERATIVE ANTIBIOTIC FOR CLEAN CASES

CONTENT

INTRODUCTION

Surgical site infections are one of the most common hospital acquired infections, which constitute 38% of surgical infections. It creates great burden to the patients by increasing hospital stay by 7-10 days. Also, it increases hospital expenditures creating an economic burden to the patient and country.

Basis of antimicrobial prophylaxis :

The basis of prophylaxis is to obtain appropriate levels of the drugs in serum and tissues that exceed the Minimum Inhibitory Concentrations (MIC) for the likely micro organisms causing a specific surgical infection.

It is considered optimal if the antibiotic is administered 30 minutes before putting a skin incision or at the time of induction of anaesthesia. Usually single dosage of antimicrobial agent is optimal for a surgical procedure unless it prolongs for more than three hours.

It is not advisable to use the antibiotics for a prolonged period due to multidrug resistant strains emergence.

Undue fear in surgeons minds :

Surgical-site infection (SSI) rate in clean surgeries and clean contaminated surgeries are 2% to 5% and upto 20% respectively. Usually

prophylaxis is not used for clean surgeries. But prevalent usage of prophylactic antibiotics in these clean procedures is due to the undue fear of infection in the minds of majority of our surgeons. Appropriate usage of antibiotics gains paramount importance due to emergence of multi drug resistant strains.

AIM AND OBJECTIVE

- To check the efficacy of single dose preoperative antibiotic versus routine perioperative usage of antibiotic.

REVIEW OF LITERATURE

Historical background:

As surgeons, though we deal with infections since the dawn of time, our understanding to treat wound infection became clear only after

the development of theory of antisepsis and the evolution of germ theory. Many observations made by nineteenth century physicians were crucial in our knowledge regarding the pathophysiology, treatment and prevention of surgical site infections.

Louis Pasteur formulated germ theory and elucidated that contagious diseases are caused by specific microbes. With the help of these principles, he pioneered techniques of sterilization. Also, he identified certain organisms responsible for human infections like *Staphylococcus*, *Streptococcus*, and pneumococcus.

Joseph lister used a solution of carbolic acid, which were used to treat sewage in his times in Europe, to dress the patients. As this reduced the post operative infection incredibly, it was quickly adopted throughout his country.

In 1880, Robert Koch, through his experiments identified pathogenic organisms associated with specific disease like cholera and tuberculosis.

Charles Mc Burney pioneered the principle of source control (i.e, surgical intervention to eliminate the source and thereby treat the infection) by performing appendicectomy as treatment of appendicitis, which was previously known to be a fatal disease. This was popularized

after been performed on the King Edward VII of England, by Sir Frederick Treves.

The discovery of effective antimicrobials helped the modern surgeons to treat wound infections in a much better way, during the twentieth century. During world war I, Sir Alexander Fleming, an army medical officer in British Medical Corps identified the first antibacterial agent Penicillin through his works on the natural action of blood against bacteria and sepsis. During his study on influenza virus, in 1928, he noticed a zone of inhibition around *Penicillium notatum* colony that grew profusely on a plate of *Staphylococcus*. He then named the substance derived as '*penicillin'*.

This subsequently led to the development of hundreds of potent antimicrobial agents against infectious organisms, which set an example

for their use as *prophylaxis against postoperative wound infection*, and became a very crucial component in the treatment of aggressive and potentially fatal surgical wound infections.

Prolific advances in the field of clinical microbiology paved way for the discovery of many new anti microbial agents against those microbes. Also the discovery of autochthonous microflora of skin, respiratory tract, alimentary tract helped modern surgeons to enhance their knowledge about the organisms which will be encountered during

surgery. However, whether these organisms were pathogenic or non pathogenic remained unclear.

With clinical observations made by veteran surgeons, Frank Meleny and William Altemier, the fact that aerobes and anaerobes synergise to cause serious infections (soft tissue infections and intraabdominal sepsis) came into limelight. So the concept that inhabitant microorganisms were not pathogenic to human body was vanished as these organisms have the potential to cause surgical infections when entered into sterile cavity during the time of surgery.

Over the few last decades, new ideas of polymicrobial nature of surgical infections were propagated. Aspirates from the peritoneal fluid of patients with perforated viscus or gangrenous appendicitis also showed the presence of aerobes and anaerobes. Trials were conducted to know the effective source control to treat these infections and antimicrobial agents were administered targetting both pathogens and commensals. William osler, one of the pioneers of American Medicine, from his observations noted that patient died due to inflammatory response in the body to a organism. This allowed our insight into the host inflammatory response to infection. It is because of activation of multiple pathways in response to an infection. So many new therapies were formulated tagetting the modified inflammatory response. Exaggerated inflammatory response seems to be the cause of end organ failure and multi organ dysfunction.

Thus, treating surgical infections and thereby preventing multi organ failure is one of the challenges faced by surgeons like us.

PATHOGENESIS OF INFECTION:

Host defences:

Barrier
Microbial flora
Humoral responses
Cellular responses
Cytokine production

Defense barriers:

Physical barriers
Chemical barriers
Immunologic barriers

Mammalian host possesses intrinsic defense mechanisms that help to prevent invasion of microbes, multiplication of organisms and thereby cause containment of infection. Our host defences are highly regulated system and are very effective in coping the invaders. They include:-

1.Site specific defences (SSD)

2.Systemic defenses

Site specific defenses provide protection at tissue level.

Systemic defences begin immediately after invasion of pathogen into sterile area of body.

Any micro organism will have to face number of barriers in the body.

1. Epithelial barrier

2. Mucosal barrier.

Mucosal barriers provided by mucosa of respiratory, gastrointestinal and urogenital system. Host barrier cells prevent invasion of microbes and proliferation by secreting certain substances. Skin commensals adherent to surface preclude virulent organism invasion, thereby forming colonization resistance.

PHYSICAL BARRIERS:

Skin:

Skin, the largest organ in the body provides most extensive physical barrier. Resident or commensal microflora on the surface of skin block the attachment of pathogens. Some of the endogenous microflora include staphylococcus, streptococcus, corynebacterium, propionibacterium species. Also, Enterococcus faecalis, Enterococcus faecium, Escherichiae coli, Enterobacteriacae and Candida albicans are isolated from skin surface below the umbilicus. Skin diseases can be associated with abnormal proliferation of skin commensals.

Respiratory tract:

Host defences in respiratory tract help to maintain sterile environment in distal bronchi and alveoli under normal circumstances. Larger particles are trapped in the mucosa of respiratory tract which are later cleared through cough. Smaller particles reaching the lower respiratory tract are cleared by pulmonary macrophages through phagocytosis. Any breach in this process leads to bronchitis or pneumonia.

Gastrointestinal tract:

Numerous microbes are encountered in many portions of gastro intestinal tract. Places where resident microflora are absent include urogenital, biliary and pancreatic ductal system under normal circumstances. However, in case of inflammation, malignancy, stone formation or catheterisation, microorganisms may proliferate. Vast number of micro organisms are found in oropharynx and colorectal region. But, organisms found in entire gastro intestinal tract are not always from oropharynx. It is because of the following reasons:

1. Highly acidic environment in stomach kills the microbes.

2. Low motility in stomach during initial phases of digestion.

Thus, microbial population in stomach accounts to approximately 10^2 to 10^3 colony forming units (CFU). But this may be increased during disease states or drug intake In terminal ileum, microbial proliferation

occurs, increasing count to approximately 10^5 to 10^8 CFUs. Exponential growth occurs in colon due to its relatively static and hypoxic environment, where aerobic species are outnumbered by anaerobic organisms to approximately 10:1.

MICROFLORA IN GASTROINTESTINAL TRACT

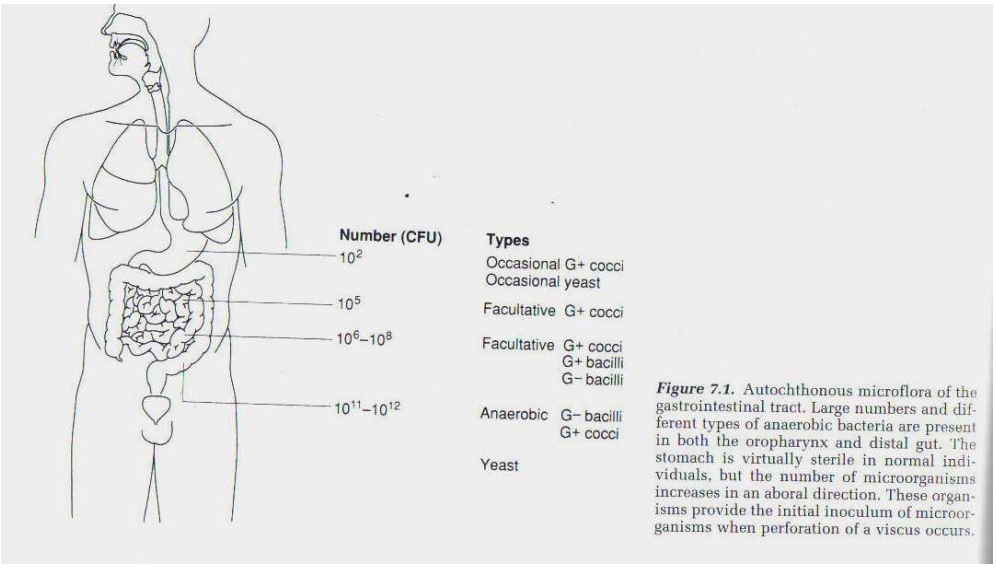


Figure 7.1. Autochthonous microflora of the gastrointestinal tract. Large numbers and different types of anaerobic bacteria are present in both the oropharynx and distal gut. The stomach is virtually sterile in normal individuals, but the number of microorganisms increases in an aboral direction. These organisms provide the initial inoculum of microorganisms when perforation of a viscus occurs.

Part of GIT Microbial population(CFU/ ML)

Stomach 10^2 to 10^3

Small intestine 10^5 to 10^8

Distal colorectum 10^{11} to 10^{12}

Along with facultative and obligate anaerobes like Bacteroides, Lactobacillus, Clostridium, Fusobacterium and Eubacterium, some aerobic microbes like Escherichia coli, Enterococcus faecalis,

Enterococcus faecium, Enterobacteriacae and Candida albicans are also present in the colon. These organisms provide colonisation resistance and prevent the entry of other organisms like Vibrio cholera, Shigella, Salmonella. But when pathology like perforation occur, the commensal organism provide nidus of infection for the pathogens to proliferate. Surprisingly very little host organisms contribute to the intra abdominal infection.

When pathogens enter specific body compartments or tissue, defense mechanisms act to eliminate or remove the nidus of infection. Apart from providing physical barrier, certain proteins like

1. Lactoferrin and Transferrin sequester microbial growth factor iron.

2. Fibrinogen in inflammatory fluid trap micro organisms and polymerises to fibrin.

3. Diaphragmatic pumping mechanism on the undersurface of diaphragm help in expunging micro organisms from peritoneal fluid.

4. Omentum, 'the policeman of abdomen' serves to limit infection.

Immunologic barriers:-

Defense mechanisms in tissues of the body ;-

a) Resident macrophages regulate cellular host defense.

b) Secretion of cytokines is upregulated by substances like TNF – alpha, IL- 1 beta and INF Gamma.

When microbes interact with defense mechanisms in body, formation of membrane attack complex and intracellular destruction by formation of phagocytic vacuoles.

Complement pathways, both alternate and classical pathways get activated after microbial invasion. Release of complement fragment (C3a, C4a, C5a) increases vascular permeability. When microbial insult occurs, chemotaxis (i.e., attraction of neutrophils to the micro organisms to the site of insult) occurs. This further leads to the influx of inflammatory fluid to the area of insult. Diapedesis of neutrophils occur within minutes and it peaks within a period of hours or days.

Response to an infection depends upon several factors:

1)Number of micro organisms entering the body.

2) Proliferation of organisms

3) Virulence of organisms

4) Potency of defense mechanism

Invasion of microbes can lead to one of the following possible outcomes.

a) Eradication of infection
b) Limitation of infection (purulent infection is the hall mark of chronic infection)
c) Locoregional infection (cellulitis, soft tissue infection)
d) Systemic infection (bacteremia)

Infection is defined as an ‘identification of microorganisms in host tissue or bloodstream, plus an inflammatory response to their presence’.

The inflammatory signs of ‘rubor, tumor, calor, and dolor’ are common, at the site of infection. Apart from these local manifestations, certain systemic manifestations like increased pulse rate and respiratory rate, elevated temperature and elevated white blood cell (WBC) count.

Above noted systemic manifestations comprise the ‘*systemic inflammatory response syndrome* ‘(SIRS). “Sepsis is not an antibiotic deficiency syndrome” SIRS when it is caused by microbial infection is termed as *sepsis* and it is mediated by production of a cascade of numerous proinflammatory mediators produced in response to the products of microbial invasion. These products can be a lipopolysaccharide (endotoxin) derived from gram-negative bacteria; or a peptidoglycan and teichoic acid from gram-positive bacteria; multiple fungal cell wall components such as mannan and numerous others. Patients have sepsis if they meet the following clinical criteria for SIRS and have an evident local or systemic infection.

Severe sepsis is defined as sepsis along with the occurence of new-onset failure of organs. It is the frequent cause of death in surgical intensive care units, with a very high mortality rate. i.e., when a patient with sepsis needs ventilatory support and is unresponsive to fluid resuscitation or one who requires vasopressors to correct hypotension, is considered to have severe sepsis.

Septic shock is a state in which patient has acute circulatory failure which is usually identified by the occurence of persistent hypotension (systolic blood pressure <90 mmHg) inspite of aggressive fluid resuscitation, with no other identifiable causes. It is the severe

manifestation of infection. It can occur in approximately 40% of patients with severe sepsis; with a very high mortality rate.

PATHOGENS OF INTEREST FOR SURGEONS

1. BACTERIA

These are little organisms which are of great importance for the surgeons, as they form the vast majority of surgical site infections.

Cell wall staining:

There are a number of species of bacteria which are identified by a specific staining called Gram's stain. This staining imparts specific colour to bacterial cell wall through which it is classified as gram positive and gram negative.

a) When they stain blue, they are termed as gram-positive bacteria. and when a bacteria stains red, it is termed as gramnegative.

Growth characteristics:

- Every bacteria have certain specific growth characteristics
- In its specific media.
- Based on a number of some characteristics, bacteria can be
- Further classified.
- It can be depending on

a) Morphological characteristics

Gram positive cocci

Gram negative cocci

b) The pattern of multiplication [e.g., single or multiplication in groups of organisms, i.e., in pairs (diplococci) or in clusters (staphylococci), or in chains of organisms. (streptococci).

c) And the presence of spores and its location.

Terminal spores

Subterminal spores

Gram-positive bacteria

The bacteria that cause surgical site infections are:

a) skin commensals

Staphylococcus aureus and

Staphylococcus epidermidis and

Streptococcus pyogenes and

These organisms cause infections either alone or in combination with other pathogenic organisms

b) *commensals of GIT* such as

Enterococci faecalis and

Enterococci faecium.

They have the capability to cause nosocomial infections like respiratory infections, catheter associated infections urinary tract infections (UTIs) and septicaemias in immunologically compromised or chronically debilitated patients. But in healthy individuals, these are of little importance.

Gram-negative bacteria:

The organisms which a surgeon specially interested among gram negative species include:

E. coli,

Proteus vulgaris and mirabilis

Klebsiella pneumonia

Serratia marcescens

Pseudomonas aeruginosa, *P. fluorescens*.

Enterobacter

Anaerobic organisms

These organisms are not able to multiply or divide in the presence of atmospheric air.

This is because of the absence of the enzyme catalase, which is important for the metabolism of reactive oxygen species.

They are the predominantly available in many areas of the human body, including oropharynx and colorectum among which flora in oropharynx is different from the one in colorectum

C. Perfringens

C.difficile

C. tetani

C. Septicum or novyi.

Bacteroides fragilis

Propionibacterium

Fusobacterium spp.

Other bacteria of interest to surgeons include:

Mycobacterium tuberculosis

M. avium-intracellulare and *M. Leprae.*

Nocardia

- These are acid fast and are very slow growing bacilli.
- They are not easily cultivated in laboratory and need specific culture media to grow which may take several weeks to months.
- They are notorious in causing severe pulmonary and extra pulmonary infections which is still prevalent in our country.

SURGICAL SITE INFECTIONS

NOMENCLATURE

• DEFINITIONS:

Earlier, the term, 'Surgical Wound Infection Task Force' (SWITF) was used to ascribe surgical site infections. The term 'SURGICAL WOUND'–was replaced by 'SURGICAL SITE INFECTION'. This term was formulated by CDC in 1992.

CATEGORIES OF SSI

SSI were categorized into two,

1. Incisional SSI

- Superficial
- Deep

2. Organ/space SSI.

Of surgical infections, 60 to 80% are incisional and the remainder are organ/space infections.

SUPERFICIAL SSI

A superficial SSI can be defined as ‘An Infection occuring within 30 days of surgery and it involves only the skin and subcutaneous tissue of incision’.

It includes:

- Purulent aspirate from the site of incision associated with or without positive culture.
- Local signs of infection and inflammation – pain, tenderness, localised swelling, redness & heat.
- Micro organisms obtained from the culture of fluid or tissue taken aseptically from a superficial incision
- Diagnosis of superficial infection made by the surgeon

Conditions which should not be considered as SSI include:

1. Stitch abscess

2. Episiotomy wound

3. Infection at the site of circumcision in a new born child.

4. Infected burn wound

DEEP INCISIONAL SSI

Deep incisional SSI can be defined as ‘An Infection that is occurring within 30 days of surgery (1yr if an implant is in place) and infection involving deep soft tissues.

It usually includes

- Purulent discharge from the site of deep incision.
- Fever of 38 degree celsius or More.
- Local pain / tenderness at the incision site and incision dehisces spontaneously or is opened deliberately.
- Abscess or other evidence of infection which involves the deep incision and found on direct examination / visual / radiological / histological examination.

- Diagnosis made by the physician / surgeon

ORGAN / SPACE SSI

An organ or space SSI can be defined as ‘An Infection occurring within 30 days (1yr of implant) or Infection involving any other part of the anatomy other than that of the incision site which was opened / manipulated at the time of surgery.

It may include

- Purulent aspirate from the organ / space operated which is identified by a drain
- Micro organisms from the culture obtained aseptically
- Infection identified during reoperation / Histological examination/ imaging.

NNIS risk index

(National Nosocomial Infection Surveillance)

NNIS framed the following variables for risk index in surgical site infection.

• ASA score – 3 or more

• Length of operation – 75th percentile of its duration to a particular surgery

• Level of contamination – contaminated/ dirty

The risk factors associated with surgical site infection can be:

I. ENDOGENOUS FACTORS

II. EXOGENOUS FACTORS

Endogenous(patient related) factors:

This includes:

1. Duration of pre operative stay of a patient in the hospital

2. Presence of any previous infection in patient

3. History of previous Abdominal operation

4. Age of the patient >50 years or < 1 yr

5. An Obese patient

6. History of Diabetes Mellitus in patient

7. Immunocompromised state or Malnutrition

8. Altered immune response

9. Usage of Tobacco

Exogenous (Perioperative factors):

The exogenous risk factors which also contribute to surgical site infection include the following:

- Prophylactic Antibiotic given to the patient before a surgery or procedure.
- Period or length of surgery – if the duration exceeds more than 3hours, additional dose of antibiotic must be given.
- Ventilation of an operating room.
- Technique handled by the operating surgeons – usage of cautery cautery, obtaining perfect haemostasis, trauma.
- Asepsis and Proper sterilization of instruments
- Length and duration of surgical scrub using betadine or alcohol (2-5mts)
- Antisepsis of skin, Though removal of hair is controversial in causing SSI, it may contribute to SSI.
- Presence of a foreign material in the surgical site

- showering of a patient before surgery
- Usage of Surgical drains(guidelines)

SURGICAL WOUND SITE SURVEILLANCE:

Surveillance of wound site is usually done by

a) sterile dressing for 24-48hrs after surgery

b) washing hands before and after changing dressing

PREPARATION OF PATIENT :

Before preparing the patient for an elective operation, the following steps must be undertaken.

- Identify and treat infections away from the surgical site before operation.
- Keep the pre-operative stay as short as possible
- Proper control of blood glucose levels
- Ask the patient to take a bath before the surgery.
- Do not remove hair unless it interferes with operation and if required, remove with electric clippers immediately before operation.

- Abstain From any forms of tobacco or alcohol consumption prior to operation

- Apply antiseptic agent in concentric circles moving towards periphery.

PREPARATION OF THE OPERATING TEAM

1. Nails should be kept clean and short

2. Surgeon should not wear any rings or hand jewellery

3. Preoperative surgical scrub for 5 minutes

4. Scrub the hands till elbows for a surgical hand washing

5. Water should always flow from hands towards elbow after a scrub

6. Always use a towel, gown and gloves which is sterile

How to manage when a person in surgical team is infected?

- Educate them to report to the team head

- Developing well-defined policies concerning patient care

- Surgical personnel with draining skin

- Must provide and collect cultures Abstain from duty, until infection has been subsided or adequate antimicrobial therapy provided.

Principles of prophylaxis

Use of multiple methods (physical, chemical, and antimicrobial therapies) or a combination of these to decrease the presence of exogenous factors (surgeon and operating room environment) and endogenous factors (microorganisms) is called *prophylaxis*

Effective Source control

The primary concept in the treatment of surgical site infections includes:

Dainage of pus

Wound débridement including infected and devitalized tissue extrusion of foreign bodies

Treatment of the root cause of infection

Antibiotic Prophylaxis

Antibiotic prophylaxis was first proposed by Miles and Burk in 1950. Prophylaxis should be planned so that it is administered at the time of induction or skin incision. Because,

- After 3 hrs of entry of infectious agent, it becomes very ineffective.
- Concentration of organisms > 100,000 / gm of tissue usually exceed the capacity of host defense.
- In the body, Humoral or cellular mechanisms defeat bacteria.

What are the Principles behind prophylaxis

- Always use the antibiotic agent which is likely to cause the probable infection
- Use full dose of any antibiotic chosen
- Administer the chosen drug prophylactically
- If duration of operation is prolonged for more than 3 hrs, give another dose of the chosen antibiotic.

Employ post operative antibiotic, when the risk of infection is increased. “The consensus is that a single dose of antibiotic immediately before an operation is enough and that there are dangers not only to hospital but also to the patients in prolonged course of prophylactic antibiotics.

Resistance to antibiotics is related closely to the prolificity with which antibiotics are prescribed”

Single dose prophylaxis

In 1977, STRACHAN and his colleagues first proposed single dose antibiotic prophylaxis. They proposed single dose of broad spectrum antibiotic prior to surgery without any usage of it after the procedure.

Trial of Single dose vs. Multiple dose of antibiotics:

Comparison was done between patients undergoing Colonic surgery receiving single dose of prophylactic antibiotic against multiple doses of antibiotics. Out of 510 surgeries done in single dose group infection rate was 4.3% and in the group of 493 patients who received multiple doses of antibiotic, the infection rate was 6.9%.

Results of 27 studies conducted were as follows:

	Single Dose	**Multiple Doses**
Operation	510	493
Infection	22	34
Rate of Infection	4.3%	6.9%

Antibiotic prophylaxis and its possible risks :

Patients with a history of allergy, urticaria or pruritic rash, bronchospasm, hypotension, local swelling, laryngeal oedema occurring even after a single dose of penicillin injection have a potential risk of anaphylaxis (type I immediate hypersensitivity). So recommendation of beta-lactams as a prophylactic antibiotic is highly condemnable. For

patients with allergy to penicillins or cephalosporins, alternative antibiotics, according to the nature of infection, has been formulated. These are very important as far as the patient's safety is concerned, failure of which may lead to a disaster.

WHO Model List – 2003

This list contains only 25 essential antibiotics for controlling most of the surgical site infections. For routine use – 19 antibiotics were recommended. For complementary use – 6 have been recommended.

NARROW SPECTRUM AGENTS

Gram positive agents include:

Penicillin

Cloxacillin

Erythromycin

Clindamycin

Vancomycin

Gram negative

Gentamycin

Ciprofloxacin

Spectinomycin

Nitrofurantoin

Nalidixic acid

Ceftriaxone

Ceftazidime

EXTENDED SPECTRUM ANTIBIOTICS

It includes antibiotics for both Gram + ve and Gram –ve organisms.

Ampicillin

Amoxycillin

Cotrimoxazole

Trimethoprim

Sulphadiazine

Amoxicillin + clavulanic acid

Imipenam +cilastatin

BROAD SPECTRUM ANTIBIOTICS

Doxycyclin

Chloramphenicol

For Anaerobic infections:

Metronidazole

Microbiological Sampling

- Sampling of the operating room must be performed on a regular basis
- Surgical instruments must be sterilized periodically according to specific guidelines
- Flash sterilization is done for the instruments that must be used immediately after a previous surgery.
- Never do flash sterilization on a routine basis and it is always advisable to keep an additional set of instruments for emergency purposes.

Surgical attire and drapes

- Cover the nostrils and mouth using a mask inside the theatre
- Until the surgery is over, it is essential to wear a mask.
- Cap that is worn must fully cover the hair of the surgeon and assistant.
- Gloves used must be sterile.

- Gloves are wore after surgical draping
- Contaminated or a visibly unsterile surgical gowns must not be worn and always discarded
- Strict aseptic technique must be maintained.
- It is important to thoroughly wash the wound so that devitalized or dead tissue is effectively debrided.
- Foreign body when present must be removed immediately
- Perfect hemostasis must be maintained
- It is advisable that a heavily contaminated wound is left open and is allowed to close by secondary intention.
- It is essential to maintain wound hygiene.
- Post-operative care of the incision must be done and kept clean.

THYROIDECTOMY WOUND SITE

Surgical site infection has always been a major complication of surgery. It has been documented for 4000-5000 years. The Hippocratic teachings described the use of antimicrobials like wine and vinegar which was used to irrigate open infected wound before secondary closure. mans also said that whenever pus located in an infected wound it has to be drained.

Koch’s postulates :

A given organism is the cause of a given disease

It must be found in every case

It should be possible to isolate from the host and grow in culture.

It should reproduce the disease when injected into another healthy host.

It should be recovered from an experimentally infected host.

The Austrian obstetrician Ignac Semmelweis showed that puerperal sepsis can be reduced from ten percent to two percent by simple hand washing.

Louis Pasteur recognized through his germ theory, microorganisms were responsible for infection and causing diseases.

Joseph Lister applied this knowledge in reducing colonization of organisms in compound fracture by applying antiseptics.

The concept of ‘magic bullet’ that could kill the microbes but not their host became reality after the discovery of sulphonamide.

Alexander Fleming discovered the antibiotic penicillin in 1928.

Many staphylococci today have become resistant to penicillin through the acquisition of β-lactamases.

It breaks the β lactam ring present in the molecular structure of many antibiotics.

There is emergence of methicillin resistant staphylococcus aureus and glycopeptide – resistant enterococci.

Faecal peritonitis wound can heal without infection in 80 – 90 % of patients with appropriate antibiotic.

Advances in the control of infection in surgery

Aseptic operating theatre technique have enhanced the use of antiseptics.

Antibiotics have reduced post operative infectious rates.

Delayed primary or secondary closure remain useful in contaminated wounds.

Physiology

Micro organisms are prevented from causing infection by intact epithelium surfaces most notably skin.

Protective mechanisms :

Chemical : low gastric pH

Humoral : antibodies, complement and opsonins

Cellular : phagocytic cells , macrophages, polymorphonuclear cells and lymphocytes.

All these natural mechanisms are compromised by surgical intervention.

Reduced host resistance to infection :

Metabolic: malnutrition (including obesity) , diabetes, ureamia, jaundice. Disseminated disease : cancer and acquired immune deficiency syndrome.

Iatrogenic : radiotherapy, chemotherapy and steroids.

When enteral feeding is suspended during perioperative period for a patient with cancer , immunosuppression, shock and sepsis, the bacteria tend to colonize the normal sterie gastro intestinal tract.

They may be then translocated to the mesenteric lymph node and may cause the release of endotoxins.

Endotoxins are the lipopolysaccharides in the bacterial cell wall.

They may cause a severe harmful systemic inflammatory response through the excessive release of the proinflammatory cytokines and activation of macrophages.

When there is reduced host resistance to infection, the microorganisms that are not pathogenic may behave as pathogens.

It is known as opportunistic infections.

The chance of developing surgical site infection is determined by the pathogenicity of the organisms.

If there is a silk suture in a tissue, the critical number of organisms needed to produce an infection is reduced logarithmically.

Closing skin with silk produce suture abscess .

Risk factors for increased risk of wound infection

Malnutrition (obesity, weight loss)

Metabolic diseases (diabetes, uraemia, jaundice)

Immunosuppresion (cancer, AIDS, steroids, chemotherapy, radiotherapy)

Colonisation and translocation in the gastro intestinal tract

Poor perfusion (systemic shock or local ischaemia)

Foreign body material

Poor surgical technique (dead space, haematoma)

There is a delay before host defences can become mobilized after a breach in epithelial surface. The acute inflammatory, humoral and cellular defences take 4 hours to be mobilized. This period is called decisive period.

At this period the invading bacteria may become established in the tissue.

The prophylactic antibiotic should be aimed to cover this period. The tissue level of antibiotic must be above the minimal inhibitory concerntration for the pathogen likely to be encountered.

Local and systemic presentation

The infection can be defined as the invasion of organisms through the tissues following a breakdown of local and systemic host defences and leading to cellulitis, lymphangitis, abscess and bacteraemia.

The infection of most surgical wounds is referred as superficial surgical site infection. (SSSI).

The other category include deep SSI in which infection present in the deep musculofascial layers.

The other category is organ space infection such as abdominal abscess after an anaestomotic leak.

Pathogens resist host defence by releasing toxins.

It is enhanced in anaerobic and frankly necrotic wounds.

Clostridium perfringens releases proteases like hyaluronidase, lecithinase and haemolysin which allow the organism to spread in the tissue and produce gas gangrene.

Resistance to antibiotic can be acquired by previously sensitive bacteria by transfer through plasmids.

Infection that occurs after admission to hospital or following

surgery is called health care associated infection (HAI).

Four main groups of HAI are

Respiratory infections including ventilator associated pneumonia.

Urinary tract infections (urinary catheters)

Bacteraemia (indwelling vascular catheters)

Surgical site infections.

Classification of sources of infection

Primary : present in or on the host so acquired from an endogenous source like superficial surgical site infection following contamination of the wound from perforated appendix.

Secondary or exogenous (HAI) : Acquired from a source outside the body like Ward (poor hand washing technique) & operation theatre (inadequate air filtration, poor antisepsis)

Major surgical site infections

It is a wound either discharges significant amount of pus or needs a secondary procedure to drain it.

Patient may have systemic signs like tachycardia , pyrexia and a raised white count.

Patient will return home lately.

Minor wound infection

It discharges pus or infected serous fluid but it may not be associated with excessive discomfort , delay in return to home or having systemic signs.

Accurate surveillance can only be achieved using trained , unbiased and blinded assessors.

Southampton wound grading systems

GRADE APPEARANCE

0 normal healing

I normal healing with mild brusing or erythema

Ia some bruising

Ib considerable bruising

Ic mild erythema

II erythema plus other signs of inflammation

IIa at one point

IIb around sutures

IIc along wound

IId around wound

III clear of haemoserous discharge

IIIa at one point only (≤ 2cm)

IIIb along wound (> 2cm)

IIIc large volume

IIId prolonged (> 3cm)

Major complication

IV pus

IVa at one point only (≤ 2cm)

IVb along wound (> 2cm)

V deep or severe wound infection with or without tissue breakdown, haematoma requiring aspiration.

The ASEPSIS wound score :

Criterion	**points**
Additional treatment	0
Antibiotics for wound infection	10
Drainage of pus under local anaesthesia	5
Debridement of wound under general anaesthesia	10
Serous discharge	Daily 0 - 5

Erythema Daily 0 - 5

Purulent exudate Daily 0 - 5

Separation of deep tissues Daily 0 - 5

Isolation of bacteria from wound 10

Stay as inpatient prolonged over 14 days 5

As result of wound infection

Types of localized infection :

Abscess

- An abscess presents with all features of inflammation such as calor (heat) , rubor (redness) , dolour (pain) and tumour (swelling).
- Along with signs of inflammation there will be function laesa (loss of function).
- If it hurts, the part is not used by the patient.
- It can be metastatic following bacteraemia.
- Predominantly staphylococcus aureus causes tissue necrosis and suppuration.
- Pus composed of dead white cells which releases oxygen free radicals , cytokines and other substances.

- Granulation tissue contains macrophages, angiogenesis and fibroblasts which forms around suppurative process and collagen gets deposited.

- Abscess is surrounded by inflammatory response containing inflammatory cells, fibrinous exudates and odema.

- If antibiotic is taken after abscess formation antibioma occurs.

- If the abscess is not reabsorbed completely or if it is not drained then it results in chronic abscess.

- Abscess tend to spread along the least resistance plane and may point towards skin.

- It may rupture on its own or may need surgical intervention to drain it.

- Abscess contain hyperosmolar material which draw in fluid which increases pressure and causes pain.

- Abscess from surgical site usually takes 7 – 10 days of surgery.

- Abscess cavity has to be cleaned after incision and drainage.

- Once the cavity is left open to drain freely antibiotic is not needed and it is only needed when the cavity is closed after incision and

drainage.

- When a pilonidal ascess is drained and closed the recurrence rate is high as nidus of hair may remain in the subcutaneous plane near the abscess.

- Small breast abscess can be treated by ultrasound guided aspiration.

- Chronic abscess lead to fistula and sinus formation.

- It contain lymphocytes and plasma cells.

- There is tissue sequestration followed by calcification.

- Organisms associated with chronic abscess are mycobacterium and actinomyces.

- In abdomen anaestomotic leak is main cause of abscess formation.

- Abscess in the deep cavity can be found by ultrasound, CT, MRI and are useful for guided aspiration and avoiding surgical intervention.

Cellulitis

- It is the non suppurative invasive infection of the tissues.

- There is poor localization .
- Spreading infection usually caused by β – haemolytic streptococci, staphylococci and clostridium perfringes.
- They release proteases which causes tissue destruction , gangrene and ulceration.
- By the release of toxins, cytokine mediated systemic inflammatory response is stimulated which produces fever, chills and rigor.
- Blood culture is negative.

Lymphangitis

- Painful red streaks is seen in the affected lymphangitis.
- The lymph nodes draining the affected lymphangitis is also painful.

Systemic inflammatory response syndrome

- It can be caused by multiple trauma , burns and pancreatitis without infection.
- It is a systemic manifestation of sepsis.
- Secondary peritonitis may lead to sepsis through the release of lipopolysaccharide endotoxin from the wall of gram negative bacteria or other bacteria or fungi.
- Toxins stimulate the macrophages to release cytokines.
- Interleukin – I and tumour necrosis factor alpha are the

proinflammatory cytokines released in SIRS.

- Septic manifestation and multi organ dysfunction syndrome in SIRS are mediated through cytokines.
- Cytokine stimulate neutrophils to adhere to the vessel wall by chemostasis.
- The activated neutrophils release lysosomal enzymes , oxidants and free radicals which kills the invading bacteria and damage the adjacent cells also.
- Coagulation, complement and fibrinolytic pathways are stimulate normally in inflammatory process.
- In presence of severe sepsis and bacteraemia this response may be harmful to the host as it occurs in excess which is known as SIRS.
- The high circulating levels of circulating cytokines and activated neutrophils causes fever, tachycardia and tachypnoea.
- The activated neutrophils adhere to the vascular endothelium away from the site of infection to the key organ and causes increased permeability .
- This causes cell damage in that organ and it become dysfunctional and give raise to multi organ dysfunction syndrome.
- If it is not controlled it progress to multiple system organ failure.
- Respiratory, renal, cardiac, liver, intestinal and circulatory failure occurs along with shock. At this stage host resistance to infection is reduced and it leads to death.
- Systemic inflammatory response syndrome should have two of the

following :

- ❖ Hyperthermia (> 38°C) or hypothermia (< 36°C)
- ❖ Tachycardia (> 90 / min, no β – blockers) or tachypnoea (> 20 / min).
- ❖ White cell count > 12000 or < 4000
- ❖ Sepsis is SIRS along with documented infection.
- ❖ Sepsis syndrome or severe sepsis
- ❖ Sepsis along with one or more organ failure.

Bacteraemia

- Bacteraemia is common in anastomotic breakdown (deep space infection)
- It may follow procedures undertaken in infected tissue like instrumentation in infected bile and urine.
- It may occur when colonization occur in indwelling catheter.
- After anaestomotic break sepsis and multiorgan dysfunction occurs.
- It is mainly caused by gram negative bacteria.
- Sepsis is common after the anaestomotic leak.
- Bacteraemia is dangerous for patients with the prosthesis.
- Surgical wound infections increases healthcare cost.
- It increases duration of hospital stay.
- It increases morbitidy.
- Prophylactic antibiotic was found to reduce the risk of infection.

FACTORS RESULTING IN FAILURE OF PROPHYLAXIS

1) Inadequate timing of antibiotic
2) Failure to readminister the antibiotic for prolonged sugeries.

PROPHYLAXIS

Administration of an antibiotic prior to contamination.

PRESUMPTIVE THERAPY

Administration of an antibiotic when there is strong possibility to be infected but it is not proved.

TREATMENT

Administration of an antibiotic where the infection has been established .

SURGICAL WOUND INFECTIONS

It is identified by

- Redness
- Warmth
- Swap culture positive from the discharge
- Purulent discharge
- Even with sterile technique and potent antibiotics surgical site infections occur in 2-9 % of all surgical procedures.

- Bacteria are found in 90% of all surgical incisions despite all aseptic precautions.

SURGICAL PROCEDURES

1) Clean
2) Clean contaminated
3) Contaminated
4) Dirty

CLEAN CASES :

1) The risk of surgical site infection is < 2%
2) Elective cases like

   Hernia, thyroid , breast, craniotomy, cardiothoracic surgeries etc.
3) There is no acute inflammation.
4) There is no transection of the gastrointestinal,genitourinary, oropharyngeal, biliary or tracheobronchial tracts.
5) There will be no break in aseptic technique
6) Antibiotic use is controversial

POST MRM

CLEAN CONTAMINATED

1) The risk of surgical site infection is 2-10%

2) Urgent or emergency cases.

3) Controlled opening of the gastrointestinal, genitourinary, orophayngeal, biliary and tracheobronchial tracts.

4) There will be minimal spillage

5) There will be minor break in aseptic precautions

6) Antibiotics used for prophylaxis.

CONTAMINATED

- Surgical wound site infection is 10-20%
- There is gross soiling of the operative field.
- Examples are :
- Colorectal surgery with spillage
- Biliary surgery in presence of infected bile
- Genitourinary tract surgery in presence of urine.
- Antibiotics used for prophylaxis.

Dirty

- ❖ Surgical wound site infection is >30%
- ❖ Purulence or abscess
- ❖ Preoperative perforation of gastro intestinal, oropharyngeal, biliary, tracheobronchial tracts.
- ❖ Penetrating trauma > 4 hours.
- ❖ Example : perforated appendicitis with abscess formation.
- ❖ Surgical wound infection depends on numerous factors.
- ❖ It may be specific to the procedure itself or to the individual person.

Surgery related factors

- Type of surgery – emergency
- Site of surgery.
- Duration of surgery.
- Previous surgry.
- Timing of antibiotic administration.
- Placement of foreign body – shunt insertion.
- Hypotension,hypothermia,hypoxia & dehydration.
- Shaving the operative site.
- Draping the patient.

- Skin antiseptics.
- Gloving.
- Hand washing.

Wound related factors

- Magnitude of tissue trauma and devitalization.
- Blood loss
- Hematoma
- Potentially bacterial contamination
- Presence of drains and packs
- Ischemia
- Wound leakage.

Patient related factors

- Age > 60 yrs.
- Weight – obesity
- Presence of remote infection
- Immunosuppresion
- Underlying disease status : diabetes, congestive cardiac failure, liver disease & renal failure.
- ASA(American society of anesthesiologists) - physical status 3,4 & 5

ASA risk factors

❖ Class 1 – normal healty patient

- Class 2 – mild systemic disease
- Class 3 – severe systemic disease not incapacitating
- Class 4 – incapacitating systemic disease that is a constant threat to life
- Class 5 – not expected to survive 24hrs with or without opertation.

Antibiotic selection

- Characteristics of an optimal antibiotic for surgical prophylaxis are
- Effective against suspected pathogen.
- Does not induce bacterial resistance
- Effective tissue penetration.
- Minimal toxicity.
- Minimal side effects.
- Long half life.
- Cost effective.
- For appropriate antibiotic use it should be administered at appropriate time and it may be repeated based on duration of the surgery or based on the half life of the antibiotic.
- Antibiotic should cover the endogenous and exogenous organisms.

- Nose – staphylococcus aureus, pneumococcus,meningococcus
- Skin – staphylococcus aureus, staphylococcus epidermidis.
- Mouth – streptococci, pneumococcus, E.coli, bacteroides, fusobacterium, peptostreptococcus.
- Urinary tract infection : E.coli, proteus, klebsiella, enterobacter
- Colon : E.coli, klebsiella, enterobacter, bacteriodes, peptostreptococci, clostridia.
- Biliary tract: E.coli,klebsiella, proteus, clostridia
- Vagina : streptococci, staphylococci, E.coli, peptostreptococci, bacteroides .
- Upper respiratory tract : pneumococcus, H.influenza
- Bacterial counts in the gastrointestinal tract vary depending on location
- Esophagus : normally < 1000 organisms / ml
- Duodenum and jejunum : 100 – 10,000 organisms / ml
- Ileum : 1 - 10 million organisms / ml
- Colon : 2/3 dry fecal matter is bacteria.
- Oral prophylactic antibiotic is given to reduce the bacterial colonization for elective colo – rectal surgery.
- Antibiotic must be present in adequate concentrations in the tissue when bacterial contamination occurs.
- Administration must be with 30 – 60 minutes of incision

- Prevention of surgical site infection through surgical techniques :
- By maintaining sterile field.
- By ensuring haemostasis to reduce the risk of haematoma
- By employing proper reconstructive technique to minimize tension on wound edges and adequate blood supply.
- Post operative wound infection is due to the predominant micro organism in that area.
- The choice of antibiotic should be directed covering that organism.
- Culture from the discharge can guide to select on the antibiotics.

Intraincisional antibiotic

- These antibiotics were administered in conjunction with local anaesthsia as a single dose before the surgery.
- Nafcillin and clindamycin was studied and found to reduce the wound infections.
- Intraincisional antibiotics were found to be :
- Inexpensive
- Easy to administer
- Well tolerated by the patient.

Staphylococcus aureus ,coagulase negative staphylococci, enterococcus, and eschericia coli remain the commonest isolated pathogens. An increasing proportion of surgical site infection is caused by the methicillin resistant staphylococcus aureus. The increased proportion of surgical site infection is caused by resistant pathogens and candida species reflect the widespread use of broad spectrum antibiotics and increasing number of severely ill and immunocompromised surgical patients.

Outbreaks of surgical site infection can be caused by unusual pathogens. These outbreaks have been traced to contaminated disinfectant solutions, contaminated adhesive dressings, colonized surgical personel & tap water.

Determinants of surgical site infections

$$\frac{\text{Dose of bacterial contamination} \times \text{virulence}}{\text{Resistance of the host patient}} = \text{Risk of SSI}$$

If the contamination of microorganisms are increased the risk of surgical site infection also increases.

Preoperative planning to reduce surgical site infction

- The patient should take bath before surgery.
- He should scrub the surgical site with antiseptic soap.

- ❖ The site on incision should be shaved or clipped the evening before the surgery.

- ❖ The surgery shold be postponded if there is presence of open skin wounds or infection of the hands or arms of the surgeon or patient having any remote infections.

Prevention of surgical site infection in the operating room

The use of antiseptic solutions for skin preparations, double gloving, drapes, use of caps, sterile gowns, masks and reducing the personnel is always considered.

Intra operative strategies

Handling soft tissue gently to avoid crushing.

Crusing caused devitalization of tissues.

Using electro cautery sparingly to control bleeding.

Electro cautery leaves behind dead tissue which is likely to get infected.

Achieving haemostasis at the surgical site.

Avoid overusing of braided silk unnecessarily.

Removing dead tissue and foreign body.

To keep the operating time as short as possible.

Avoiding to leave a dead space within the surgical wound site.

Using closed suction drain through separate stab incision.

Drain help to prevent tissue fluid being accumulated in the dependant part of the wound.

Delaying primary closure for the wound that are severely contaminated and dirty.

By following these technical details the surgical site infection can be brought out to minimum.

Post operative prevention of surgical site infection

Changing the dressing after 24 to 48 hours and promptly discharging the patient will reduce surgical site infection.

Enhancement of host defences

Three new strategies

Increased oxygen delivery

Experimental evidence supporting increased oxygen delivery has a favorable influence in preventing infection.

A prospective randomized trial for elective colonic surgery has

demonstrated clinical value of administering supplement oxygen.

Optimizing body core temperature

Better intra operative and post operative managent of temperature may reduce surgical site infection.

Blood glucose control

Better control of blood glucose appears to have a value in reduction of surgical site infection.

Adverse effects of hyperglycemia may be an important contributor for surgical site infections and non surgical site infections in diabetic and non diabetic patient.

Economic impact of surgical site infections

Surgical site infections impose a heavy cost on the patient as well as on the health care.

Prolongation of stay and extra charges were attributed to nosocomial infections.

Antibiotic prophylaxis

Antibiotic prophylaxis refer to a brief course of antimicrobial agent administered just before an operation begins in order to reduce intra operative microbial level that will not overwhelm host defencesand result in infections.

Appropriately administered antibiotic will reduce the surgical site infection.

Antibiotic prophylaxis is one of the preventive measures to reduce surgical site infections.

The efficacy of antibiotic prophylaxis to prevent surgical site infection is found to be very significant.

A single dose pre operative antibiotic is as effective as full five day course of therapy for an uncomplicated procedure.

Prophylactic antibiotic should target the anticipated organisms.

Contaminated ,dirty and complicated procedure should receive additional post operative coverage.

Antibiotic prophylaxis should be administered after every 3 hours for prolonged procedure.

Prophylactic antibiotic should be administered within 2 hours before the skin incision.

Administering parental antibiotic before the skin incision ensures adequate serum and tissue antimicrobial level are present at the time of contamination.

Choice of prophylactic antibiotic

The microbial content and the hospital environment may influence the choice of antibiotic.

In majority of procedures staphylococcus species cause infections.

So cephalosporins is considered as sufficient prophylaxis for

majority of procedures.

The antibiotic chosen for the prophylaxis should be able to administer to treat the infection also.

The chosen antibiotic must reflect the local , disease specific common pathogen and their susceptibility.

If there is severe adverse effect for a antibiotic previously it is better to preclude that particular antibiotic.

A comprehensive risk assessment should be a part in selection of appropriate antibiotic.

Treatment policies should be based on the local information about the epidemiology of drug resistant bacteria.

Timing of antibiotic

The preoperative period antibiotic is administered two hours before the surgery.

The perioperative period antibiotic is administered with three hours of incision.

The postoperative period antibiotic is administered three hours after the incision but within twenty four hours of incision.

Among those who received preoperative antibiotic the surgical site infection rate is 0.6 %.

Among those who received perioperative antibiotic the surgical site infection rate is 1.4 %.

Among those who received postoperative antibiotic the surgical site infection rate is 3.3 %.

Stepwise logistic regression analysis confirmed that administration of antibiotic in the pre operative period is associated with reduced risk of surgical site infection.

The lowest rate of surgical site infection was observed when antibiotic was administered 30 -120 minutes before surgery.

Prophylactic antibiotic are best when administered during the induction of anaesthesia.

The half life of most antibiotic used is less than two hours.

For maximum antibiotic effectiveness, the tissue level of antibiotic must be adequate for the duration of the expected period of contamination.

If the antibiotic is given at the time of induction of anaesthesia , the highest concerntration at tissue and serum level was maintained throughout the surgery.

For caesarean section prophylaxis should be delayed until cord is clamped to prevent antibiotic reaching the neonate.

When a tourniquet is to be applied to a limb, the concentration of antibiotic must reach the limb before the application of tourniquet.

Single dose prophylaxis

As long as adequate serum drug level is maintained during the operation single dose is often sufficient.

Antimicrobial prophylaxis for cardio thoracic surgery recommended by the American Society of Health System Pharmacist to continue prophylaxis upto 72 hours after surgery.

Prolonged use of antimicrobial is associated with emergence of resistant bacterial strains.

Prophylactic antibiotic dosing

The drug should be provided in adequate dose based on the body weight or body mass index.

Administration of antibiotic should be repeated intra operatively if the duration of surgery prolong two half lives after the first dose to achieve adequate antimicrobial level until wound closure. Patient

receiving 2 gm of cefazolin had low surgical site infection compared to patient receiving 1gm of cefazolin. Administration of additional dosage after the surgery does not provide any additional prophylactic benefits.

Redose for long surgeries

Serum antibiotic level is reduced by blood loss and fluid replacement especially during the first hour of surgery when the drug level in the serum is high.

If blood loss is > 1500 ml and if haemodilution is > 15ml/kg, additional source of antibiotic should be given after fluid replacement. Following postoperative pneumonia, surgical site infection is the common complication following surgery.

Common sources of infection

Surgical wards, wounds, ulcers, drains, catheters, urine, sputum, urine, faeces & open wounds.

Operation room without proper sterilization of instruments, proper ventilation and proper operating techniques.

Organoisms causing surgical site infection

- Commonly staphylococcus aureus.
- Colonization refers to presence of bacteria without signs and

symptoms of systemic inflammation.

❖ Transient exposure of a wound to bacteria is called contamination.

Sequence of events in surgical wound

Activation of inflammation occurs by cut, incision, abarasion and burn.

Protein coagulation, mast cell activity, platelet aggregation, release of complements and bradykinin.

Phase I of inflammation begin with vasodilatation and increased vascularity.

Phase II inflammation proceeds with phagocytic infiltration, bacterial hagocytosis, release of proinflammatory cytokines.

Monocytes activate and produce myofibrocytes and collagen and thus regulate wound healing.

If bacterial contamination is not controlled proinflammatory cells release TNF α to stimulate neutrophils for phagocytosis.

It also releases of reactive oxygen and acid hydrolases, interleukins and evoking acute inflammatory response with the formation of pus.

Pus contains necrotic tissue, neutrophils, bacteria and proteinaceous fluid.

Factors related to surgical site infection

Bacterial inoculation occurs through instruments, surgeons, air in operating room, theatre staff, patient's endogenous bacteria like perineum, urine etc.

Host defences natural and acquired when altered surgical site infection occurs.

Bacterial virulence plays a vital role.

Microenvironment in the wound like haemoglobin at wound site and presence of necrosis which interferes with phagocytosis.

Risk classification and identification system

It is based on three variables

1) Microbial contamination at the surgical site
2) Duration of operation
3) Host susceptibility.

The national nosocomial infections surveillance system as basic SSI risk index :

NNIS	**POINT**
Operation classified as contaminated or dirty	1
Patient having ASA score of 3,4 & 5	1
Duration exceeds 75th percentile of 'T' point	1

Classification of wound infection according to the etiology

Primary infection :Wound is the primary site of infection

Second infection : It occurs following a complication that is not related to the wound.

Classification of wound infections according to the time

Early infection : within 30 days

Intermediate infection : 1 – 3 months

Late infection : > 3 months

Classification of wound infection based on severity

- minor wound infection : discharge without cellulitis or deep tissue destruction .
- major wound infection : discharge of pus with tissue breakdown with systemic illness.

Prevention of SSI :

Preoperative skin wash with chlorhexidine decreases bacterial colonization by 80 %.

- Clean wound infection after shaving is 2.3 %.
- Clean wound infection after clipping is 0.9 %.
- Clean wound infection without shaving or clipping is 0.9%.

- Prolonged preoperative admission should be avoided for an elective case.

Preventive antibiotic therapy :

- It is used when the patient has a high NNIS risk index.
- It is used when there is possibility of high risk of infection with the procedure.
- Postoperative systemic antibiotic after 24 hours had not shown to reduce surgical site infection.
- Proper techniques and wound microenvironment is more important than the antibiotic.

Enhancement of host defences:

- Optimising body temperature is important as warmer patient resist bacteria better.
- Increased oxygen delivery helps in phagocytic eradication of microbes.
- Blood glucose level is important even for non diabetic patients.

Management of surgical site infections :

- Debriment : All infected material and pus should be removed from the wound site.

- Sutures should be removed for free drainage of infected material.
- Infected fluid is sent for culture and sensitivity and appropriate antibiotic should be started.
- Infected wound after showing health granulation tissue, secondary suturing is done or often allowed to heal by scarring.

Gas gangrene

- This is caused by clostridium perfringes.
- They are anaerobic, gram positive spore bearing bacilli found in faeces and soil.
- It occurs in military, traumatic surgery and colorectal operations.
- Patients with diabetics, immune compromised and malignancy are at higher risk when they have a foreign body or necrotic tissue which favours anaerobic environment.
- Military wound has the ideal environment as high velocity missile causes excessive tissue damage.
- The cavity that the wound created would have cloth and soil by the missile along with devascuolarised tissue.
- The wound discharges thin sweet smelling brown liquid .

- ❖ Gram staining of that fluid will show bacteria.
- ❖ Odema and gangrene spreads following the release of hyaluronidase , collagenase , proteases and alpha toxin.
- ❖ It is followed by systemic complications , circulatory collapse and multi system organ failure.
- ❖ When amputation has to be performed for pheripheral vascular disease prophylactic antibiotic has to be given.

Synergistic spreading gangrene (synonym : subdermal gangrene , necrotizing fasciitis) **:**

It is caused by clostridia, coliforms, bacteroides species, staphylococci, peptostreptococci and anaerobic streptococci.

Scrotal infection is known as Fournier's gangrene and abdominal infection as Meleney's synergistic hospital gangrene. Patients are almost immunocompromised. Severe wound pain, smell and spreading inflammation are signs of spreading infection. The subdermal spread of gangrene is always much more extensive that appears on initial examination. Debriment should be extensive and wound is laid open and later covered with split skin grafting.

Treatment of surgical infection

- ❖ Cellulitis around the wound take 3 – 4 days to develop.

- Suppurative wound infection take 7 – 10 days to develop.
- Patient with cellulitis and spreading infection needed to be treated by appropriate antibiotic.
- Initially empirical antibiotic was started later changed to specific antibiotic based on culture and sensitivity report.
- Change of antibiotic causes resistance and complication like c.difficle enteritis.

- If the wound got infected and pus formed and wound got infected sutures has to be removed and pus has to be let out to drain freely.
- If the wound got infected severely then wound is left open to granulate.
- Since day care surgeries are done many surgical site infections go unnoticed.
- Pus has to taken freshly and sent in a transport medium with adequate quantity so the microbiologist can provide information for appropriate antibiotic .
- If results are negative and bacteraemia is suspected then blood culture can be sent.

- ❖ A rapid report can be obtained by gram staining.
- ❖ Aerobic and aerobic culture and sensitivity done by disc diffusion method.
- ❖ Minimal inhibitory concentration for a antibiotic , endotoxins and cytokine levels are measured.

- ❖ Polymeric films are used as incisional drapes and to cover suture wounds.
- ❖ Dressings are available to help in debriding open infected wound , absorb excessive exudates , encourage epithelialisation and formation of granulation tissue.
- ❖ They also contribute to antibacterial environment around the wound.
- ❖ The use of topical antibiotic has to avoided as it may cause allergy and resistance.
- ❖ Topical antibiotic prevents epithelial ingrowth so it should be used in superficial wound only.

Surgical dressings :
Debriding agents :
Benoxyl – benzoic acid
Aserbine – benzoic acid

Variclene – benzoic acid
Used in necrotic sloughing wound
It provides acid environment
It improves healing by debriment action

Enzymatic agents :

Varidase – streptokinase / streptodornase
Activate fibrinolysis and liquefy pus in chronic wound ulcer

Bead dressings :

debrisan
iodosorb
Remove bacteria and excess moisture in deep granulating tissue by capillary action.

Polymeric films :

Opsite
Biocclusive
Tegaderm
Primary adhesive transparent dressing for sutured wound and donor site.

Foams :

Sialistic
Lyofoam
Allevyn
Elastomeric dressing can fit deep cavity wound.

Hydrogels :

Geliperm
Intrasite
Maintain moist environment and absorb moisture and it is semipermiable and allows diffusion of air.

Hydrocolloids :

Comfeel
Granuflex
Complete occlusion without exchange of gases .
It provides moist environment, promotes epithelialisation and granulation tissue.

Fibrous polymers :

Kaltostat
Sorbsan
Absorptive alginate dressing.

Used to pack deep cavity wounds.

Biological membranes :

Porcine skin

Amnion

Used for superficial chronic skin ulcers.

Tulles :

Non adherent paraffin impregnation

Absorptive dressing used to absorb exudates.

Prophylactic antibiotics :

It is given to prevent infection after surgery or instrumentation.

The concentration of the antibiotic at the tissue level when the incision is made when the local defence mechanisms has not been established or contamination of the wound has not occurred.

In long surgery the antibiotic can be repeated at approximately 4 hour interval during surgery.

During that period the tissue level concentration would have been low.

The choice of antibiotic should cover the expected spectrum of organisms.

Patient with known heart valve disease or orthopaedic implant should receive prophylactic antibiotic during dental , urological and open viscus surgery.

Prophylactic regimens

Vascular surgery :

Organisms :

Staphylococcus epidermitis

Staphylococcus aureus

Aerobic gram negative bacilli

Regimen :

One dose of augmentin with or without gentamicin.

Vancomycin or rifampicin if methicillin resistant staphylococcus aureus is suspected.

Orthopaedic surgery :

Organisms :

Staphylococcus epidermidis

Staphylococcus aureus

Regimen :

One dose of augmentin

Oesophagogastric surgery :

Organiosms :

Enterobacteriaceae

Enterococci

Regimen :

One dose of second generation cephalosporin and metronidazole in severe contamination.

Biliary surgery :

Organisms :

Enterobacteriaceae mainly Escherichia coli.

Enterococci mainly streptococcus faecalis

Regimen :

One dose of a second generation cephalosporin

Small bowel surgery :

Enterobacteriaceae

Anaerobes mainly bacteroids

Regimen :

One dose second generation cephalosporin with or without metronidazole.

Appendicectomy :

Organisms :

Enterobactaeriaceae

Anaerobes mainly bacteroides.

One dose of second generation cephalosporin or gentamicin with metronidazole.

Colorectal surgery :

Organisms :

Enterobacteriaceae

Anaerobes mainly bacteroids

Regimen :

One dose of second generation cephalosporin or gentamicin with metronidazole

Preoperative preparation :

Short preoperative hospital stay lowers the risk of acquiring

Methicillin resistant staphylococcus aureus (MRSA)

Multiple resistant coagulase negative staphylococcus (MRCNS)

Hospital acquired infection (HAI)

Medical and nursing staff should wash their hands before and after touching a patient. Alcoholic hand gel can be used as a substitute for hand washing. It may not protect from c. difficile which causes psuedomembranous colitis. Staff with open infected wound should not enter the theatre. Antiseptic (chlorhexidine) bath can be taken.

Shaving has to be done just before the surgery.

The infection rate doubles if shaving was done the night before the surgery. Minor skin injuries enhances superficial bacterial colonization. Hair clipping has the low rate of infection.

Antiseptics used in general surgery practice

Chlorhexidine :

Alcoholic 0.5 %

Aqueous 4 %

Uses :

Skin preparation

Surgical scrub in dilute solutions in open wounds

Effective against gram positive organisms.

Povidone – iodine (betadine) :

Alcoholic 10 %

Aqueous 7.5 %

Uses :

Skin preparations.

Surgical scrub in dilute solutions in open wound.

Safe , broad spectrum , fast acting and sporadicidal.

Cetrimide : (**savlon**)

Aqueous

Uses :

Hand washing

Instrument and surface cleaning

Surface active agent.

Alcohols :

70 % ethyl, isopropyl

Uses :

Skin preparation.

Disinfectants

Hypochlorites :

Aqueous preparations (eusol , Milton , chloramines T)

Instrument and surface cleaning

Toxic to tissues

Hexachlorophene :

Aqueous bisphenol

Skin preparation.

Hand washing

Effective against gram negative organisms.

Scrubing and skin preparation

Application of alcoholic antiseptic to skin reduces bacterial count by 95 %. Aqueous antiseptics used for hand washing and scrub should include nails. Maintainence of theatre discipline will reduce infection rate. The number of staff in the theatre should be kept to the minimum. The people moving in and out of the theatre should be kept to the

minimum. Careful monitoring of theatre ventilation and instrument sterilization would reduce infectious rate.

Gentle manipulation , dissection of tissues and limited using of diathermy will reduce the infectious rate. Dead space and haematoma formation has to be avoided. The avoidance of perioperative hypothermia and supplemental oxygen during recovery will reduce surgical site infection.

Post operative care of wounds

Secondary surgical site infections i.e exogenous SSI and hospital acquired infection are due to poor hospital standards. MRSA is an indicator for poor post operative wound care management. Careful audit should be conduted and there should be change in practice to reduce infectious rate. The contamination is measured by sample tissue at the end of operation from the wound edge. The contamination is related to the infectious rate. For clean cases the infectious rate before the prophylaxis is 1- 2 % and after the prophylaxis is 1-2 %.

For clean contaminated cases the infectious rate before prophylaxis is 20 – 30 % and after prophylaxis is < 10 %. For contaminated cases the infectious rate before the prophylaxis is upto 60 % and after prophylaxis is 15 – 20 %.

For dirty cases the infectious rate before prophylaxis is upto 60 %

or more and after prophylaxis is < 40 %.

Bacteria involved in surgical infection

Streptococci

- Streptococci are gram positive cocci.
- They form chains.
- The β – haemolytic streptococci is a important bacteria causing surgical infection.
- It resides in the pharynx.
- Group A streptococci also known as streptococcus pyogenes which release enzymes such as streptolysin , streptokinase and streptodornase and has the ability to spread cause cellulitis and causes tissue damage.
- Streptococci faecalis is an enterococcus.
- Streptococci pyogenes and streptococci faecalis both are associated with wound infection after large bowell surgery.
- They are sensitive to penicillin and erythromycin.
- Cephalosporins are an alternative to penicillin.

Staphylococci :

- It is a gram positive bacteria .
- It form clumps.
- It causes exogenous suppuration i.e pus formation in wounds.
- Methicillin resistant staphylococcus aureus can cause epidemics.
- Vancomycin resistant strains have also emerged.
- Patients found MRSA positive were denied access to hospital.
- Swapping, isolation of patients , ward to be closed and disifection of ward are considered.
- The infection caused by staphylococcus aureus is localized and suppurative.
- Most staphylococcus produces β lactamase and are resistant to penicillin but are sensitive to vancomycin, flucloxacillin, aminoglycosides, some cephalosporins and fusidic acid.
- The newer antibiotics are effective against resistant strains.
- Linezolid – good oral activity
- Tigecycline – wide spectrum
- Daptomycin – good activity in bacteraemia
- The newer antibiotic are expensive and have bone marrow

suppression , renal toxicity and hepatic toxicity.

- Staphylococcus epidermidis or staphylococcus albus or coagulase negative staphylococci is a major threat in prosthetic vasucular and orthopaedic surgery.
- They cause hospital acquired infection.

Clostridia :

- They are gram positive obligate anaerobic bacteria.
- They produce spores.
- Clostridium perfringes causes gas gangrene.
- Clostridium tetani causes tetanus.
- Clostridium difficile causes pseudomembranous colitis.
- It also causes hospital acquired infections.
- Pseudomembranous colitis is caused by overuse of antibiotics particularly in elderly and immunocompromised people.
- It is also caused due to poor hygiene.
- Patient will have bloody diahoea and may present with perforation and needs resection and treatment with antibiotics like vancomycin and metronidazole.

- Identification of toxin is an early diagnostic test.

Aerobic gram negative bacteria

They are normal inhabitant of large bowel. E.coli , proteus and klebsiella species acting in synergy with bacteroids causes surgical site infection. E.coli is the major cause of urinary tract infection particularly in relation to catheterization. Pseudomonas species tend to colonise burns , tracheastomy wounds and urinary tract. Carbapenes (meropenem) are used in severe infections.

- **Bacteroids**
- They are strict anaerobes .
- They colonize large bowel , vagina and oropharynx.
- They act in synergy to cause surgical site infection.

Principles of antimicrobial treatment

Only spreading infection and patient having systemic infection justify using systemic antibiotic. When ever possible culture and sensitivity has to be obtained for appropriate treatment. Until the culture and sensitivity report comes it is better to start antibiotic empirically . If there is no improvement in the condition of the patient then there is chance of missing a precise diagnosis.

Use of antibiotic is indicated in spreading infection , systemic illness like systemic inflammatory response syndrome or multi organ dysfunction syndrome.

The appropriate treatment of localized surgical site infection is interventional radiological drainage of pus or open drainage and debriment.

Two approaches for antibiotic therapy

A narrow spectrum antibiotic:

- It is used to treat a know sensitive infection.
- Treating MRSA using vancomicin.
- Broad spectrum antibiotics :
- It is used when the bacteria is not know or when several bacteria is suspected to cause the infection.
- e.g emergency surgery done for ischaemic bowel perforation .
- In this case triple – therapy combination of broadspectrum penicillin with an aminoglycoside and with metronidazole may used preoperatively and postoperatively to support body defences.
- An alternative to penicillins are piperacillin tazobactam and

carbapenem.

- A failure of response to antibiotic may indicate a failure of infection source control.
- If there is poor response to antibiotic after 3- 4 days then further evaluation has to be done and pus culture has to be send again.

Antibiotics used in treatment and prophylaxis of surgical infection :

Antimicrobials are produced by living organisms (antibiotic) or can be synthesized. They can kill the bacteria or prevent its growth Penicillins act on bacterial cell wall. Aminoglycosides act at ribosomal level preventing the production of proteins required to maintain the integrity of the cell wall.

Penicillin

Benzylpenicillin is effective against gram positive pathogens. Actinomyces which causes chronic wound infection is sensitive to penicillin. Gas gangrene need high dose of intravenous benzylpenicillin.

Flucloxacillin

It is a β lactamase resistant penicillin. It is used in community acquired staphylococcal infections.

Ampicillin and amoxicillin

These are β – lactam penicillins It is available for oral and parental use.

It is effective against enterobacteriaceae, enterococcusfaecalis and majority of group D streptococci.

Mezlocillin and azlocillin

These are ureidopenicillins. They are active against enterobacter , klebsiella & bacteroids. They are susceptible to β – lactamases. Clavulanic acid is available in combination with amoxicillin. Clavulanic acid protect amoxicillin from the β – lactamases.

It is used in localized cellulitis , superficial staphylococcal infections infected animal and human bite.

Cephalosporins

Cefuroxime , cefotaxime are effective against intra abdominal skin and soft tissue infections. Cephalosporins may combined with an aminoglycoside and an imidazole for anaerobic coverage.

Aminoglycosides

It is active against gram negative enterobacteriaceae. It causes ototoxicity and nephrotoxicity following high doses. It has marked post antibiotic effect.

Vancomycin

It is a glycopeptide. It is effective against gram positive bacteria. It is used in MRSA cases and pseudomembranous colitis. It may produce ototoxicity and nephrotoxicity.

Imidazoles

Metronidazole is most widely used imidazole. It is active against anaerobic bacteria. It can be administered orally , rectally or intravenously. It is used for the prophylaxis and treatment of anaerobic infections after abdominal , colorectal and pelvis surgeries.

Carbapenems

They are active against gram positive bacteria. It has broad spectrum anaerobic action. Meropenm , ertapenem and imipenem are members of carbapenems. It is used in serious mixed abdominal infections (peritonitis).

Quinolones

It is active against wide spectrum of organisms.

MATERIALS AND METHODS

SOURCE

Patient admitted in kilpauk medical college in department of general surgery from may 2014 to September 2014.

TYPE OF STUDY

Experimental randomized controlled study.

SAMPLING METHOD

Convinience sampling

SAMPLE SIZE

100 members.

50 – control

50 – study group

INCLUSION CRITERIA

People of age from 15 – 70 years.

People without any co morbidity

Thyroid surgery (Hemithyroidectomy & total thyroidectomy)

Hernia surgery (Hernioraphy)

Breast surgery (Lump excision & Modified radical mastectomy)

Patient of both sex.

EXCLUSION CRITERIA

Any surgery more than 3 hours

Patient with diabetic , hypertensive , immune compromised or with any co morbitidies.

STUDY METHODOLOGY

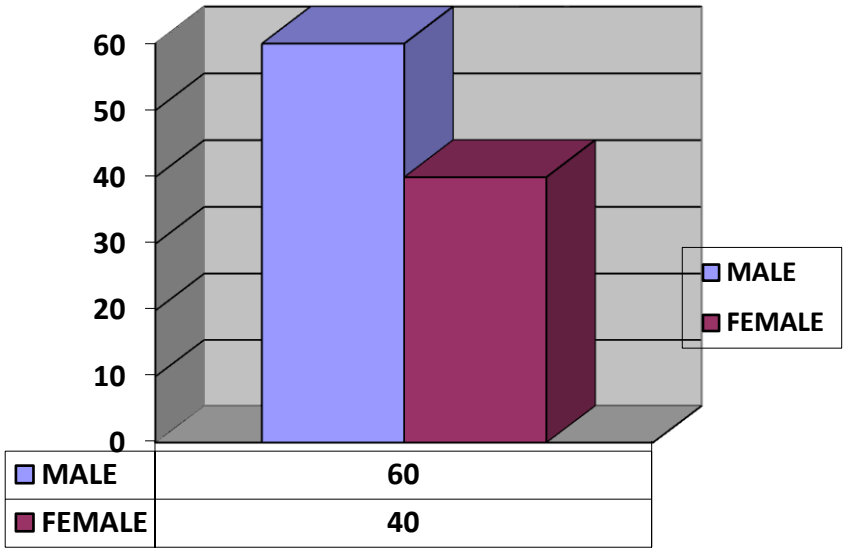
For 50 persons in the study group was given cefotaxime 2gram iv stat half an hour before the surgery. No post operative antibiotic was given . If they had signs of infection (redness , warmth , tenderness or discharge from the wound) empirical antibiotic will be started . Swap culture and sensitivity will sent . Based on culture and sensitivity report appropriate antibiotic will be given. If wound shows signs of infection single stitch will be removed to drain the collected fluid and swap will be taken.

For the 50 persons in the control group cefotaxime 1g will be given half an hour before surgery and followed by post operative antibiotic of cefotaxime 1g iv bd.

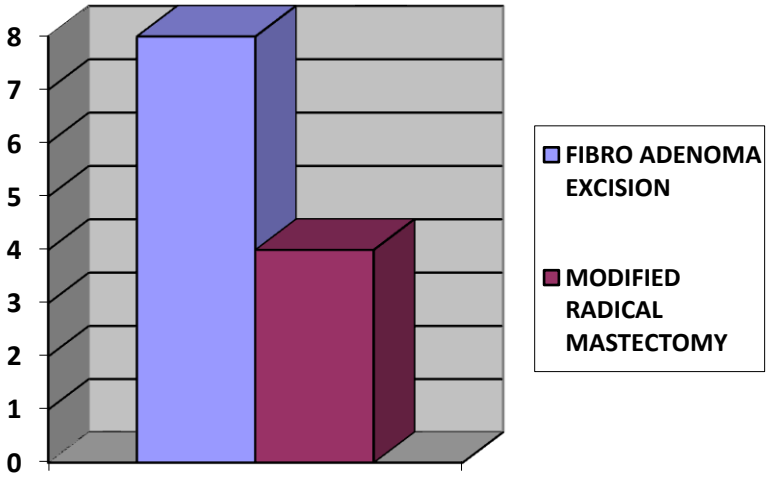
In study group wound will be inspected daily for redness , warmth , tenderness and discharge.

OBSERVATION

TOTAL NO.OF CASES

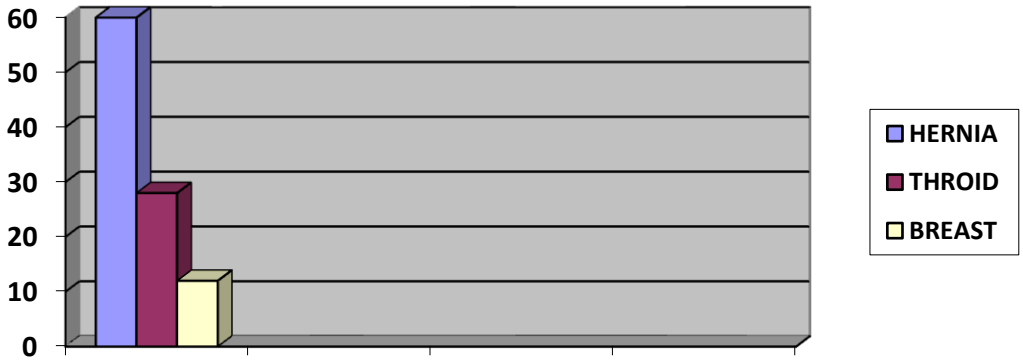


BREAST SURGERY

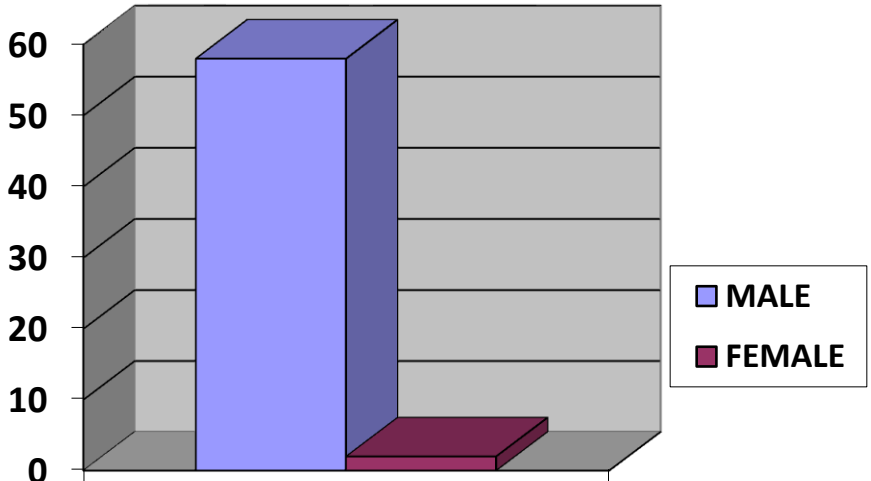


FIBROADENOMA EXCISION	8
MODIFIED RADICAL MASTECTOMY	4

SURGERY

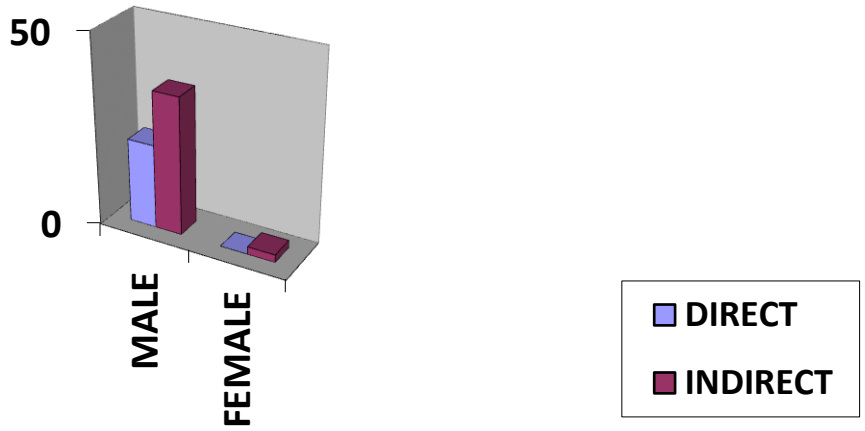


HERNIA SURGERY



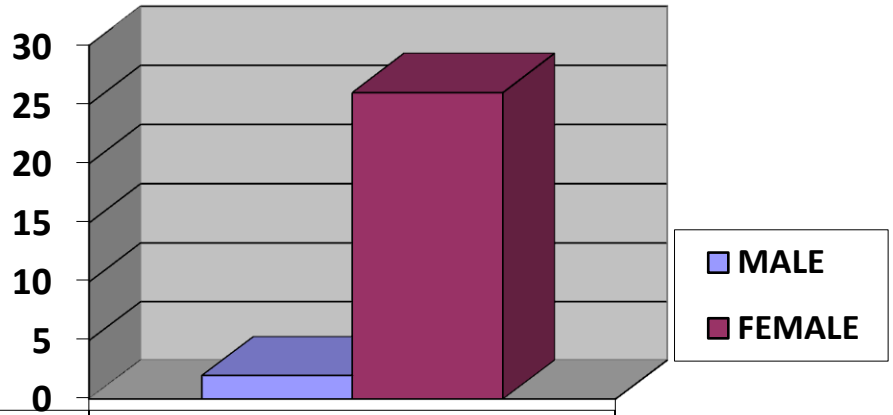
MALE	58
FEMALE	2

TYPES OF HERNIA IN MALE AND FEMALE



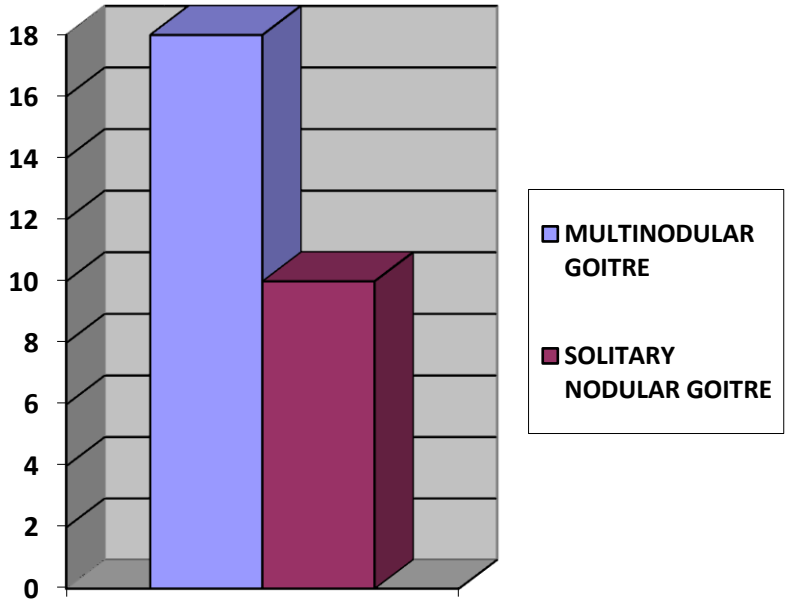
	MALE	FEMALE
DIRECT	22	0
INDIRECT	36	2

THYROID SURGERY



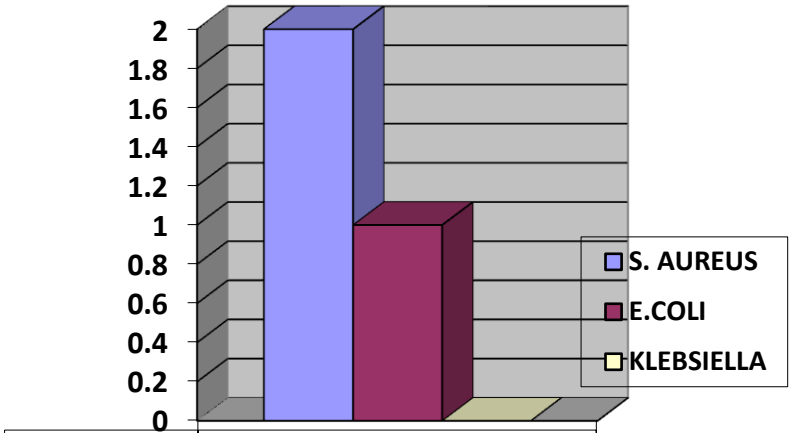
MALE	2
FEMALE	26

PATHOLOGY OF THYROID



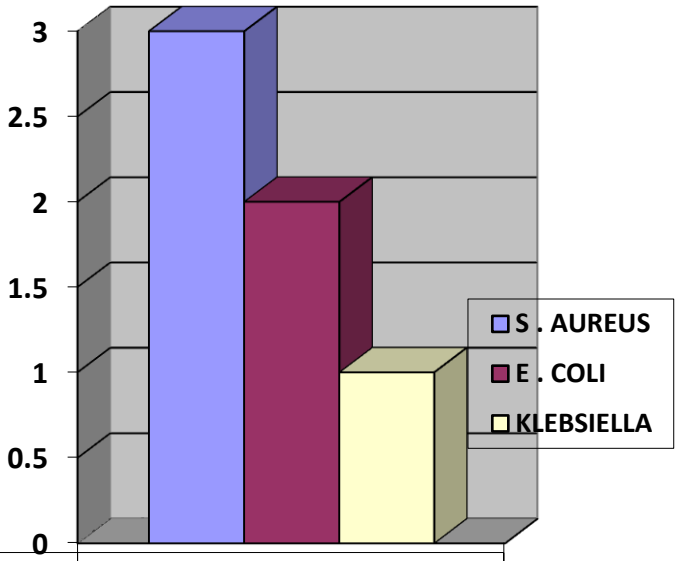
MULTI NODULAR GOITRE	18
SOLITARY NODULAR GOITRE	10

ISOLATES FROM STUDY GROUP



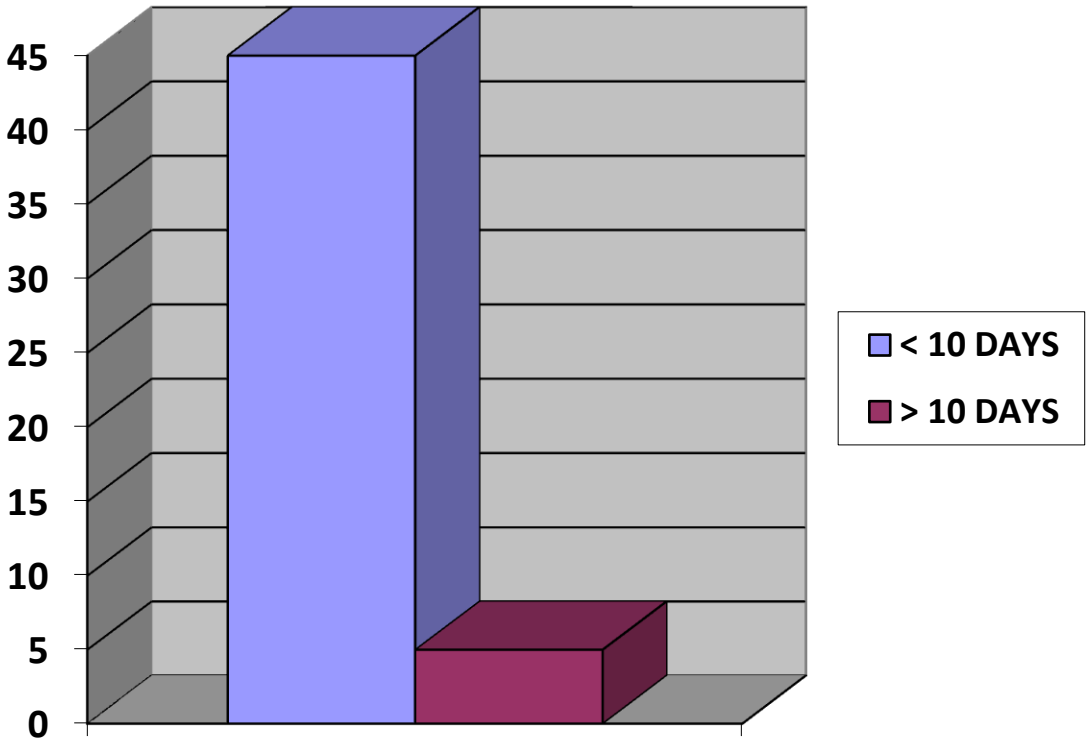
S. AUREUS	2
E.COLI	1
KLEBSIELLA	0

ISOLATES AMONG CONTROL GROUP



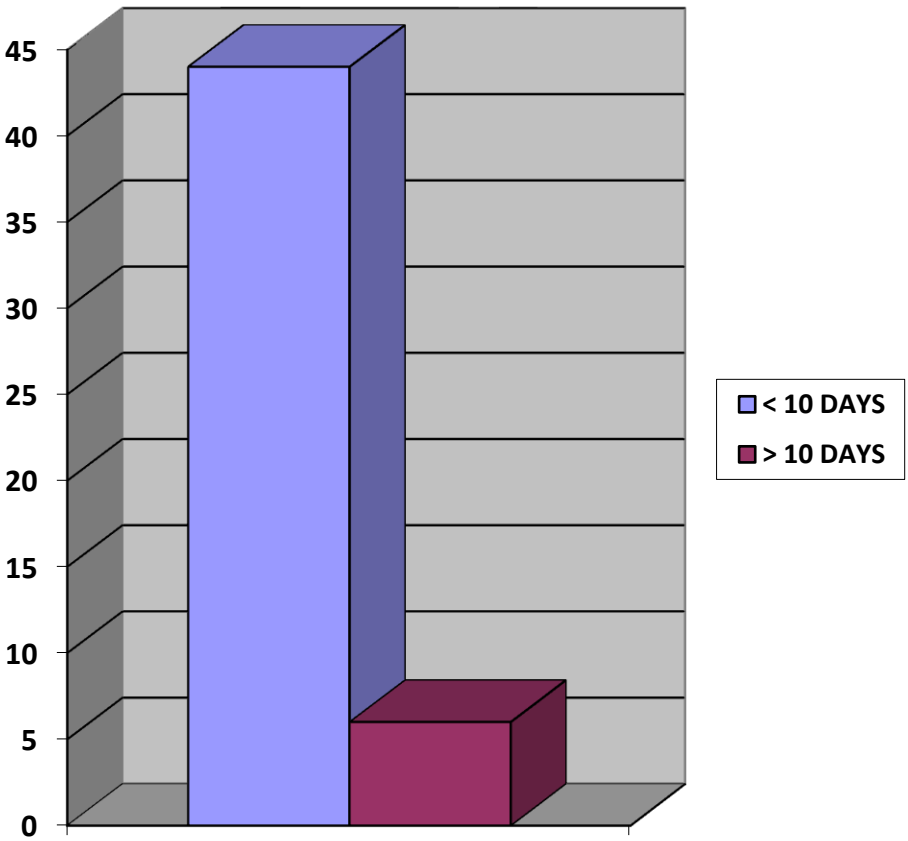
S . AUREUS	3
E . COLI	2
KLEBSIELLA	1

OPERATIVE DURATION OF STAY IN STUDY GROUP



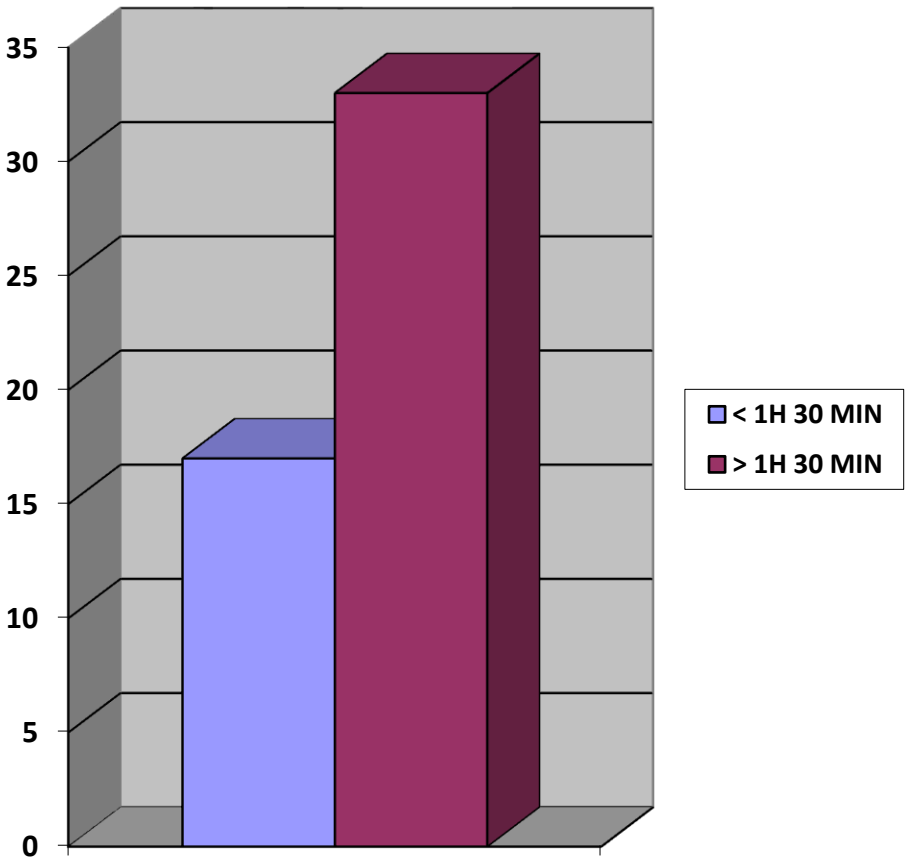
DURATION OF STAY	< 10 DAYS	>10 DAYS
PATIENTS	45	5

DURATION OF POST OPERATIVE STAY IN CONTROL GROUP



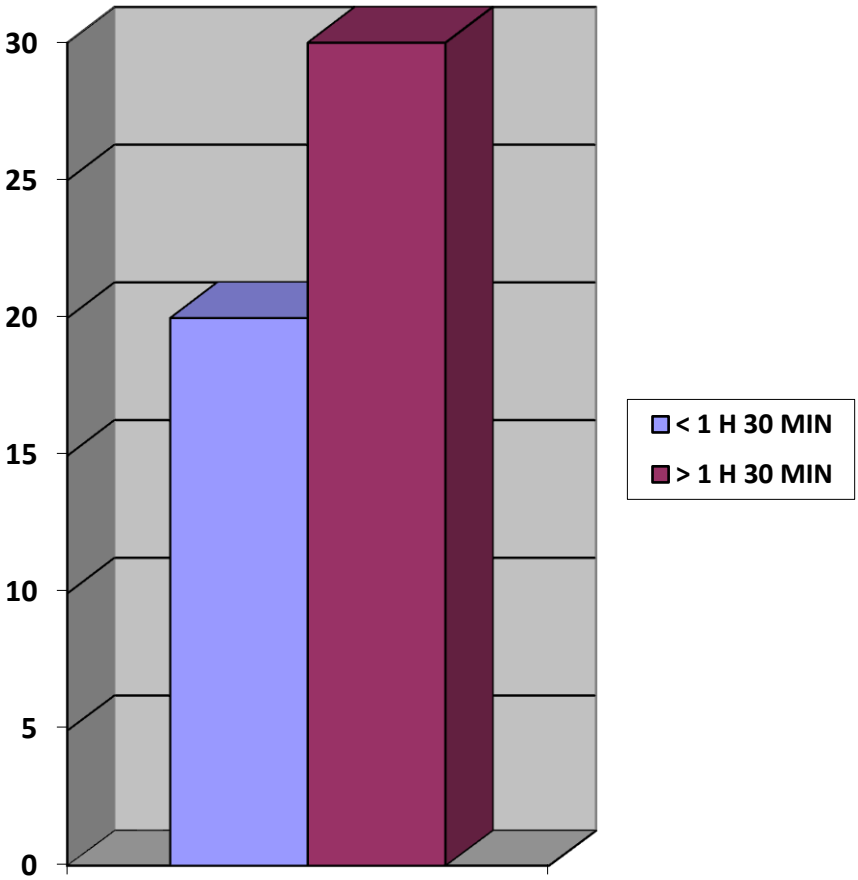
DURATION OF STAY	< 10 DAYS	>10 DAYS
PATIENTS	44	6

DURATION OF SURGERY IN STUDY GROUP



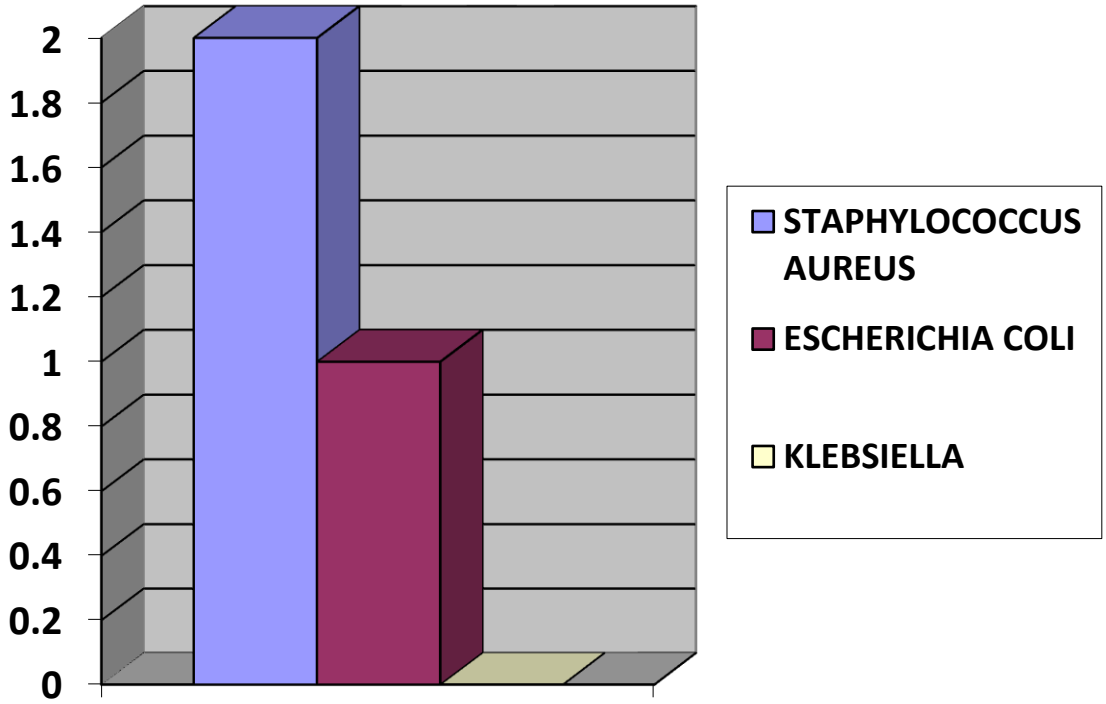
DURATION OF SURGERY	< 1 HOUR 30 MIN	> 1 HOUR 30 MIN
PATIENT	17	33

DURATION OF SURGERY IN CONTROL GROUP



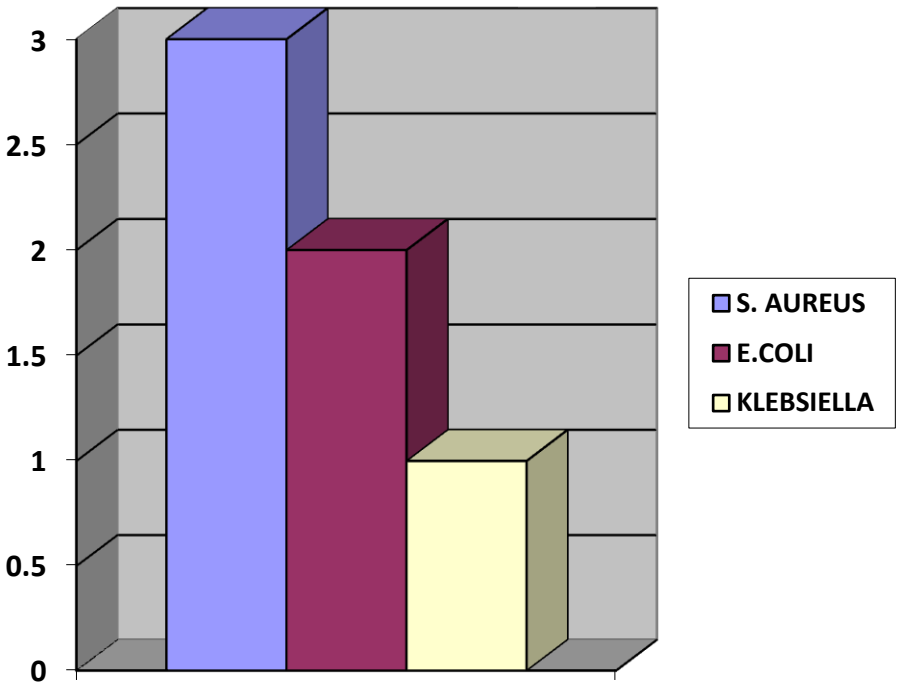
DURATION OF SURGERY	< 1 HOUR 30 MIN	> 1 HOUR 30 MIN
PATIENT	20	30

ISOLATES IN SURGICAL SITE INFECTION AMONG STUDY GROUP



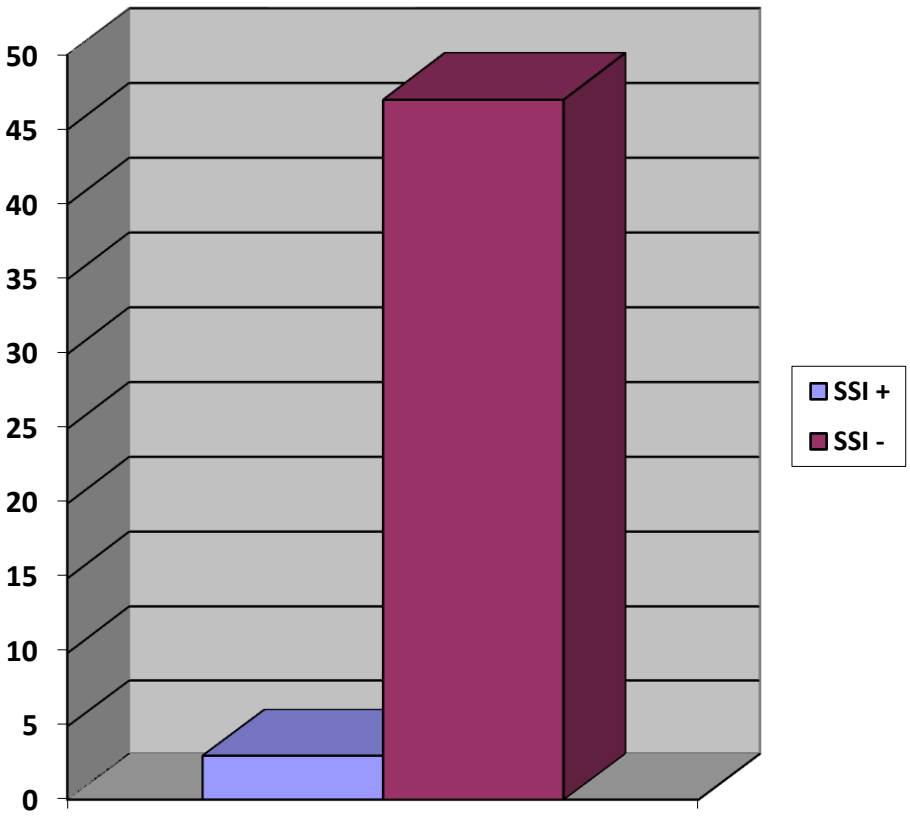
ISOLATES	TOTAL NO.
S. AUREUS	2
E.COLI	1
KLEBSIELLA	0

ISOLATES FROM SURGICAL SITE INFECTION AMONG CONTROL



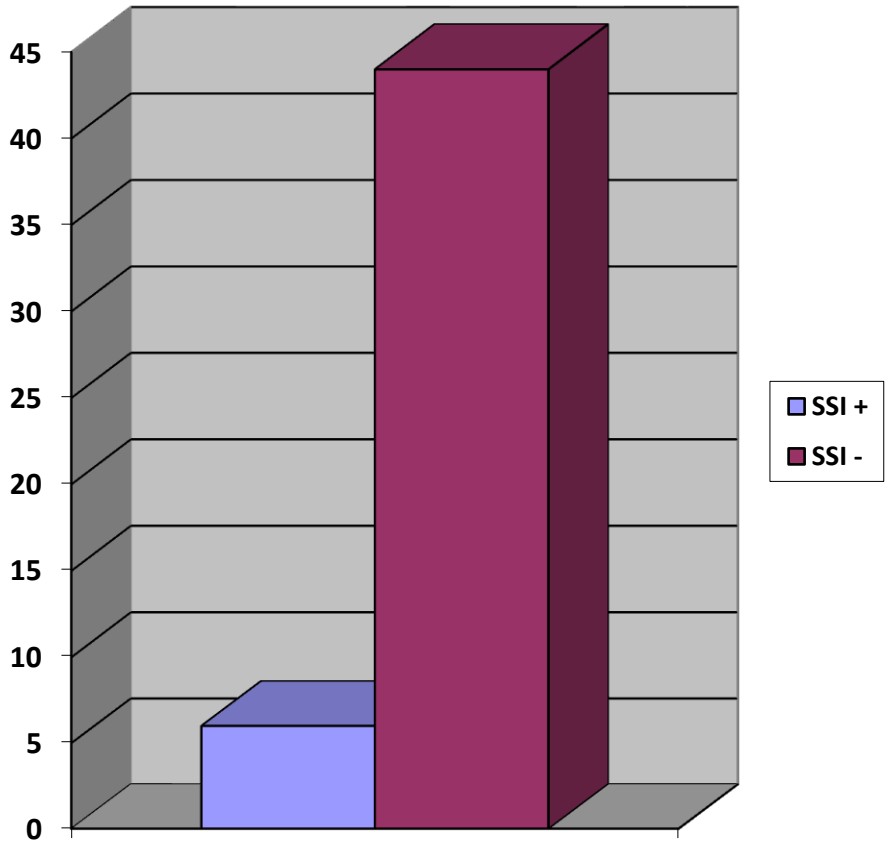
ISOLATES	TOTAL NO.
STAPHYLOCOCCUS AUREUS	3
ESCHERICHIA COLI	2
KLEBSIELLA	1

SURGICAL SITE INFECTION AMONG STUDY GROUP



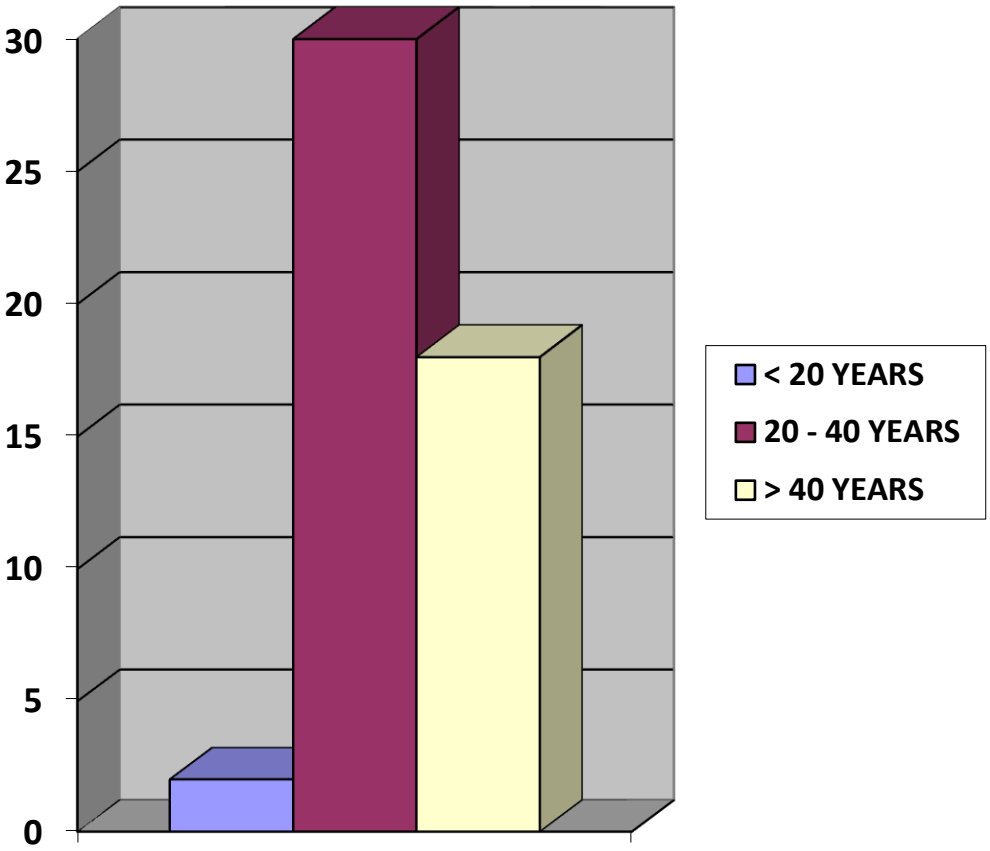
WOUND INFECTION	TOTAL NO.
SURGICAL SITE INFECTION PRESENT	3
SURGIAL SITE INFECTION ABSENT	47

SURGICAL SITE INFECTION AMONG CONTROL GROUP



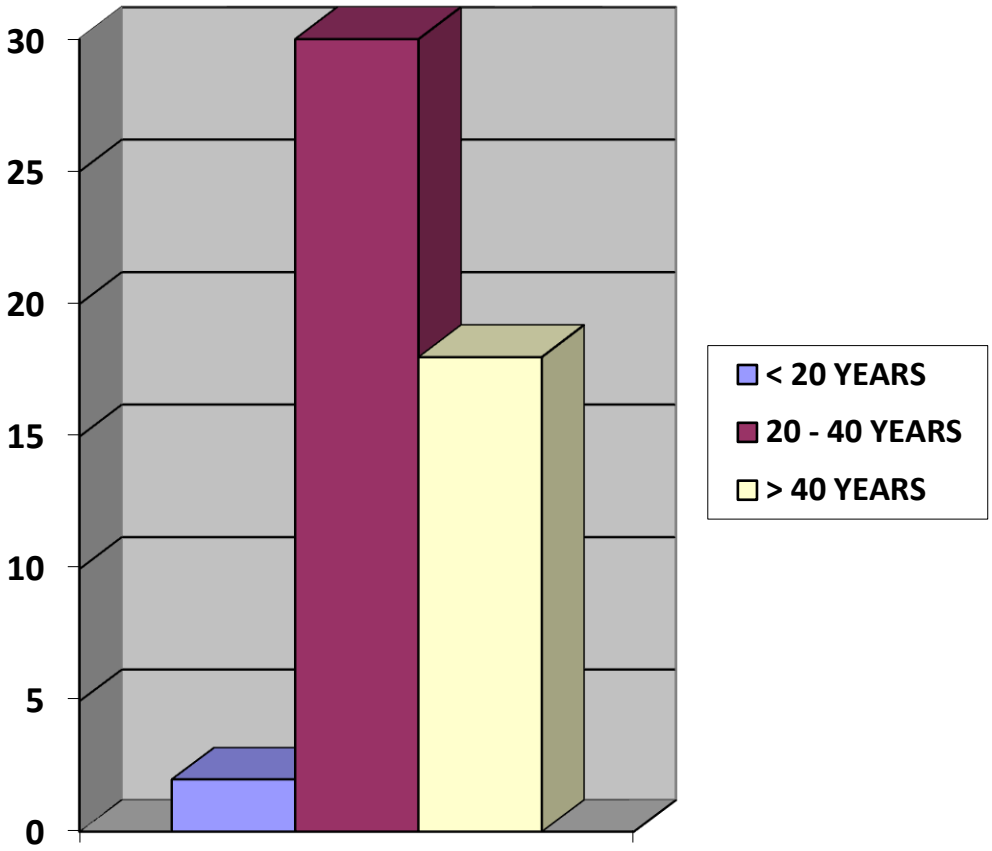
WOUND INFECTION	TOTAL NO.
SURGICAL SITE INFECTION PRESENT	6
SURGIAL SITE INFECTION ABSENT	44

AGE DISTRIBUTION AMONG STUDY GROUP



AGE DISTRIBUTION	TOTAL NO.
< 20 YEARS	2
20 – 40 YEARS	30
> 40YEARS	18

AGE DISTRIBUTION AMONG CONTROL GROUP



AGE DISTRIBUTION	TOTAL NO.
< 20 YEARS	2
20 – 40 YEARS	30
> 40YEARS	18

WOUND INFECTION RATE AMONG PATIENTS

P VALUE – 0.452 (NOT SIGNIFICANT)

Wound infection	Study Group	Study %	Control Group	Control %
SSI +	3	**6**	**6**	**12**
SSI -	**50**	**100**	**50**	**100**

DISCUSSION AND SUMMARY

The term Clean surgeries describes the procedures where in a sterile technique is strictly adopted and any of the tracts like GIT, respiratory and genitor-urinary tracts are not entered.

Apart from the factors like the operating team and the risk factors of the patient which contributes to the risk of infection, the operating atmosphere and the sterility of the instruments and the effort which is taken to maintain asepsis also interferes with the rate of surgical infection.

It is rather not fair for a surgeon to prescribe an antibiotic when there is any breach in the technique of asepsis as it is never a substitute to asepsis. In a clean surgery, the infection is almost always entered the operative field from an exogenous source like skin of the patient or the nostrils of the operating team.

In this study the factors like hypertension, diabetes mellitus or any other co-morbities, immunocompromised state, malnutrition, previous surgeries, hypersensitivity to any antimicrobial agents have been excluded.

As per the literature, the rate of infection after a clean surgery is 1.5% and is hardly more than 4%.

This study performed in our institution among 50 patients in the study group 3 developed surgical site infection. Among 50 patients of the control group 6 developed surgical site infection. The p value is 0.452 which is non significant. When p value become < 0.05 it become significant.

CONCLUSION

Majority of our surgeons still use postoperative antibiotics in clean procedures because of undue fear of infection in their mind. This study conclude that a single dose of preoperative antibiotic prophylaxis is effective in decreasing postoperative wound infection in clean surgeries. It will help in decreasing healthcare cost. It will help in reducing antibiotic related morbidity, such as drug toxicity, antibiotics related diarrhea, superinfection. It will also help in decreasing resistant strains of bacteria due to overuse of antibiotics.

By avoiding post operative antibiotic in clean surgical cases we can avoid bacterial resistance, reduce patient discomfort and complications, reduce health care cost, conserve man power and preserve national resources.

To conclude postoperative antibiotic is not needed for clean surgical cases. Single dose pre operative antibiotic is sufficient.

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PROFOMA

NAME :

AGE :

SEX :

IP NO :

ADDRESS :

DEPARTMENT :

HOSPITAL :

UNIT :

DATE OF ADMISSION :

DATE OF SURGERY :

DIAGNOSIS :

PROCEDURE :

DURATION OF SURGRY :

TO LOOK FOR : (UPTO 10 DAYS)

FEVER

WARMTH

TENDERNESS

REDNESS

DISCHARGE

SWAB CULTURE AND SENSITIVITY :

MASTER CHART FOR THE CONTROL GROUP

S.no	Name	Age	Sex	Ip.no	Diagnosis	Procedure	Duration of surgery	Ssi	Isolates	Duration of post op stay
1	Rajesh	23	M	1428002	Indirect hernia	Hernioraphy	1 hour	N	-	6
2	Mani	38	M	1428011	Indirect hernia	Hernioraphy	2 hours	Y	S.aureus	13
3	Kumar	46	M	1428024	Indirect hernia	Hernioraphy	1h 30 min	N	-	2
4	Vikram	43	M	1428037	Indirect hernia	Hernioraphy	2h 15 min	N	-	7
5	Muthu	32	M	1428049	Indirect hernia	Hernioraphy	1 hour	N	-	9
6	Basupathi	32	M	1428061	Indirect hernia	Hernioraphy	2 hours	N	-	6
7	Raghul	46	M	1428074	Indirect hernia	Hernioraphy	2h 15min	N	-	6
8	Sriram	38	M	1428085	Indirect hernia	Hernioraphy	1h 25min	N	-	4
9	Muthuram	47	M	1428099	Indirect hernia	Hernioraphy	1 hour	N	-	4
10	Maruthu	33	M	1428101	Indirect hernia	Hernioraphy	2 hours	N	-	2
11	Ravi	39	M	1428119	Indirect hernia	Hernioraphy	1h 20 min	N	-	4
12	Subramani	33	M	1428128	Indirect hernia	Hernioraphy	2 hours	Y	S.aureus	14
13	Kalidass	32	M	1428139	Indirect hernia	Hernioraphy	2 hours	N	-	2
14	Kumar	28	M	1428168	Indirect hernia	Hernioraphy	2 hours	N	-	4
15	Sekar	21	M	1428172	Indirect hernia	Hernioraphy	2 hours	N	-	5
16	Raghu	29	M	1428201	Indirect hernia	Hernioraphy	2 hours	Y	S.aureus	15
17	Karthik	36	M	1428221	Indirect hernia	Hernioraphy	1 hour	N	-	3
18	Vignesh	36	M	1428245	Indirect hernia	Hernioraphy	2 hours	N	-	4
19	Mugesh	58	M	1428258	Direct hernia	Hernioraphy	2 h 10 min	N	-	7
20	Ramar	52	M	1428269	Direct hernia	Hernioraphy	1 hour	N	-	5
21	Manickam	66	M	1428273	Direct hernia	Hernioraphy	1 hour	N	-	8
22	Kaesavan	59	M	1428285	Direct hernia	Hernioraphy	1h 35 min	N	-	6
23	Vaelayutham	63	M	1428291	Direct hernia	Hernioraphy	2 hours	Y	E.coli	14
24	Thilakar	68	M	1428201	Direct hernia	Hernioraphy	1 hour	N	-	7
25	Durai	55	M	1428221	Direct hernia	Hernioraphy	1 hour	N	-	4
26	Vellu	62	M	1428234	Direct hernia	Hernioraphy	1 hour	N	-	6
27	Chandran	56	M	1428237	Direct hernia	Hernioraphy	1 hour	N	-	8
28	Raja	64	M	1428249	Direct hernia	Hernioraphy	2 hours	N	-	4
29	Ganeshan	56	M	1428256	Direct hernia	Hernioraphy	1 hour	N	-	5
30	Banu	37	F	1428267	Indirect hernia	Hernioraphy	1 hour	N	-	4
31	Suresh	34	M	1428277	Mng	Total thyroidectomy	2 hour	N	-	5
32	Sarasu	23	F	1428287	Mng	Total thyroidectomy	2h 15 min	N	-	3
33	Sumathi	27	F	1428293	Mng	Total thyroidectomy	2 h 30 min	N	-	2
34	Suchitra	32	F	1428299	Mng	Total	2h 10	N	-	3

						thyroidectomy	min			
35	Suleka	35	F	1428301	Mng	Total thyroidectomy	1h 45 min	N	-	5
36	Rekha	48	F	1428312	Mng	Total thyroidectomy	2h 20min	Y	Klebsiella pneumonia	11
37	Priya	45	F	1428323	Mng	Total thyroidectomy	2 hours	N	-	3
38	Divya	37	F	1428333	Mng	Total thyroidectomy	1h 50 min	N	-	3
39	Bharathi	32		1428347	Mng	Total thyroidectomy	2h 10 min	N	-	4
40	Sivaranjini	39	F	1428367	Solitary nodular goitre	Hemi thyroidectomy	1h 45 min	N	-	3
41	Swathi	23	F	1428398	Solitary nodular goitre	Hemi thyroidectomy	1 h 35 min	N	-	2
42	Ashwini	27	F	1428411	Solitary nodular goitre	Hemi thyroidectomy	1 h 25 min	N	-	3
43	Amutha	23	F	1428427	Solitary nodular goitre	Hemi thyroidectomy	2 hours	N	-	2
44	Nathiya	38	F	1428439	Solitary nodular goiter	Hemi thyroidectomy	1h 50 min	N	-	3
45	Kirutika	26	F	1428448	Fibroadenoma	Excision	15 min	N	-	1
46	Kausalya	19	F	1428453	Fibroadenoma	Excision	20 min	N	-	1
47	Vijaya Lakshmi	18	F	1428467	Fibroadenoma	Excision	10 min	N	-	1
48	Shyama	23	F	1428477	Fibroadenoma	Excision	20 min	N	-	1
49	Savithri	38	F	1428486	Carcinoma breast	Mrm	2h 25 min	N	-	7
50	Saraswathi	49	F	1428493	Carcinoma breast	Mrm	2 h 50 min	Y	E.coli	14

MASTER CHART FOR THE STUDY GROUP

1	Name	Age	Sex	Ip.no	Diagnosis	Procedure	Duration of surgery	Ssi	Isolates	Duration of post op stay
1	Ramar	28	M	1427517	Indirect hernia	Hernioraphy	2 hours	N	-	7
2	Kashif	35	M	1427523	Indirect hernia	Hernioraphy	1 hour	N	-	8
3	Kaesavan	40	M	1427539	Indirect hernia	Hernioraphy	1h 40 min	N	-	3
4	Vinoth	46	M	1427578	Indirect hernia	Hernioraphy	2h 35 min	Y	S.aureus	14
5	Mohan	38	M	1427678	Indirect hernia	Hernioraphy	2 hours	N	-	9
6	Veeraiya	29	M	1427683	Indirect hernia	Hernioraphy	1 hour	N	-	4
7	Ramachanthran	42	M	1427692	Indirect hernia	Hernioraphy	2h 25min	Y	S.aureus	12
8	Neducheliyan	33	M	1427732	Indirect hernia	Hernioraphy	1h 35min	N	-	4
9	Sengutavan	41	M	1427756	Indirect hernia	Hernioraphy	2 hours	N	-	3
10	Musthafa	36	M	1427788	Indirect hernia	Hernioraphy	1 hour	N	-	5
11	Pillai	37	M	1427901	Indirect hernia	Hernioraphy	1h 40 min	N	-	6
12	Anbu	39	M	1427923	Indirect hernia	Hernioraphy	1 hour	N	-	2
13	Raman	32	M	1427945	Indirect hernia	Hernioraphy	2 hours	N	-	1
14	Boopathi	24	M	1427987	Indirect hernia	Hernioraphy	1 hour	N	-	3
15	Chandru	27	M	1427991	Indirect hernia	Hernioraphy	1 hour	N	-	4
16	Saran	28	M	1428111	Indirect hernia	Hernioraphy	1 hour	N	-	5
17	Cheralathan	32	M	1428134	Indirect hernia	Hernioraphy	2 hours	N	-	2
18	Nakkiran	33	M	1428147	Indirect hernia	Hernioraphy	1 hour	N	-	3

19	Farooh	55	M	1428153	Direct hernia	Hernioraphy	2 h 30 min	Y	E.coli	13
20	Manickam	59	M	1428167	Direct hernia	Hernioraphy	2 hours	N	-	11
21	Manoj	60	M	1428173	Direct hernia	Hernioraphy	2 hours	N	-	12
22	Parthiban	56	M	1428187	Direct hernia	Hernioraphy	1h 25 min	N	-	5
23	Ravi	63	M	1428196	Direct hernia	Hernioraphy	1 hour	N	-	7
24	Maruthi	65	M	1428201	Direct hernia	Hernioraphy	2 hours	N	-	6
25	Sethu	58	M	1428221	Direct hernia	Hernioraphy	1 hour	N	-	3
26	Raju	63	M	1428234	Direct hernia	Hernioraphy	1 hour	N	-	5
27	Mari	57	M	1428237	Direct hernia	Hernioraphy	2 hours	N	-	7
28	Elilavan	64	M	1428249	Direct hernia	Hernioraphy	1 hour	N	-	2
29	Mannan	53	M	1428256	Direct hernia	Hernioraphy	2 hours	N	-	3
30	Fathima	33	F	1427701	Indirect hernia	Hernioraphy	2 hours	N	-	5
31	Kashif	35	M	1427724	Mng	Total thyroidectomy	2 hours	N	-	3
32	Banu	23	F	1427741	Mng	Total thyroidectomy	2 hours	N	-	4
33	Parvathy	25	F	1427787	Inmng	Total thyroidectomy	2 hours	N	-	1
34	Manju	33	F	1427797	Mng	Total thyroidectomy	2h 30 min	N	-	2
35	Vimala	36	F	1427805	Mng	Total thyroidectomy	1h 30 min	N	-	3
36	Rani	42	F	1427823	Mng	Total thyroidectomy	2 hours	N	-	5
37	Kanimozhi	41	F	1427837	Mng	Total thyroidectomy	2h 25 min	N	-	4
38	Yuvarani	38	F	1427845	Mng	Total thyroidectomy	2 hours	N	-	2
39	Suseela	33		1427887	Mng	Total thyroidectomy	2h 35min	N	-	2
40	Sumathi	37	F	1427893	Solitary nodular goiter	Hemi thyroidectomy	2h 45 min	N	-	2

41	Saroja	27	F	1427901	Solitary nodular goitre	Hemi thyroidectomy	2 hours	N	-	3
42	Revathy	26	F	1427911	Solitary nodular goitre	Hemi thyroidectomy	2 h 25 min	N	-	2
43	Ramya	24	F	1427923	Solitary nodular goitre	Hemi thyroidectomy	2 hours	N	-	2
44	Rajeshwari	37	F	1427934	Solitary nodular goiter	Hemi thyroidectomy	2 hour	N	-	2
45	Vaitheki	21	F	1427945	Fibroadenoma	Excision	15 min	N	-	1
46	Mariyam	18	F	1427954	Fibroadenoma	Excision	20 min	N	-	1
47	Shakila	17	F	1427967	Fibroadenoma	Excision	10 min	N	-	1
48	Shyama	22	F	1427977	Fibroadenoma	Excision	15 min	N	-	1
49	Sumathi	39	F	1427987	Carcinoma breast	Mrm	2h 15 min	N	-	8
50	Papathi	48	F	1427999	Carcinoma breast	Mrm	2 hour	N	-	9

INSTITUTIONAL ETHICAL COMMITTEE
GOVT.KILPAUK MEDICAL COLLEGE,
CHENNAI-10
Ref.No.1589/ME-1/Ethics/2014 Dt:06.03.2014.
CERTIFICATE OF APPROVAL

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval "A Clinical Study on Preoperative single dose antibiotics in clean surgery" – For Project Work submitted by Dr.P.Raja Prabaharan, MS (GS), PG Student, KMC, Chennai-10.

The Proposal is APPROVED.

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

GOVT. KILPAUK MEDICAL COLLEGE
29 MAY 2014
Kilpauk, Chennai-10.

29/5/14
CHAIRMAN,
Ethical Committee
Govt.Kilpauk Medical College,Chennai

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